U.S. ENVIRONMENTAL PROTECTION AGENCY

VESSEL SAFETY MANUAL

Office of Administration and Resources Management
Safety, Health and Environmental Management Division

Washington, DC

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SECTION 1 - INTRODUCTION

1.0 Scope and Policy

Scope: This document describes safe vessel specifications and operational procedures as required by EPA's National Maritime Safety Program. The manual has been developed with the goal of minimizing risk to all persons who embark upon an EPA vessel.

Policy: It is EPA policy that the operation of all EPA vessels will be governed in accordance with the requirements set forth in this manual.

1.1. Background and Authority

Background: The President, through Executive Order Number 12196, and the Secretary of Labor, through Section 19 of the Occupational Safety and Health Act, and 29 CFR 1960, require that all Federal Agencies establish comprehensive safety and health management programs.

Authority: In accordance with EPA Directive Number 1440, "Occupational Safety and Health Manual", the Director for the Safety, Health, and Environmental Management Division (SHEMD), under the supervision of the Director, Office of Administration, is responsible for developing Agency occupational safety and health policies, programs, standards, goals, and objectives for evaluating the effectiveness of the programs at all operational levels.

SHEMD provides safety and health support for the Agency's National Occupational Safety and Health programs to Program Offices, Regional Offices, and Laboratories. This program and related standards and guidance have been established by the Assistant Administrator for Administration and Resources Management.

The authorities cited in EPA Order Number 1440 pertain to safety and health policies, programs, and standards, including those related to protection from maritime hazards. As such, comprehensive efforts to minimize employee exposure to accidents and enhance safety awareness aboard EPA vessels, as described in the Program, correspond to the intent of Executive Order Number 12196, the Occupational Safety and Health Act, the regulations established by other federal agencies, and the mandate for SHEMD.

1.2 Program Applicability

This program applies to **all EPA owned or operated vessels, from the largest to the smallest**, that are operated on any body of water, foreign or domestic; and all EPA activities and employees on any EPA occupied or controlled vessel, or conducted in support of EPA vessel operations.

Notes:

1/ The term "EPA workers" is occupational in nature and includes full-time, part-time, temporary, and permanent EPA employees; and detailees to the EPA from other governmental agencies.
2/ Students, eighteen years of age or older, enrollees in the EPA's Senior Environmental Employment (SEE) Program; students assigned to the EPA; EPA stay-in-school program participants; interns and fellows assigned to the EPA; may be designated as EPA Workers by the EPA Vessel Management Official. If they are so designated as EPA Workers, they must comply with all applicable requirements of this manual.

Based on local conditions and requirements, Regions may wish to establish more stringent requirements than those set forth in this manual. If this is required, the provisions of this program may be supplemented, but not replaced or superseded, by Regional and Program requirements.

1.3 Changes This manual will be modified from time to time as dictated by experience, changing operational requirements, and changes to the referenced regulations and authorities. All EPA employees are encouraged to submit recommendations to SHEMD, through their individual organizations, whenever they perceive the need for a change or an additional requirement. Proposed changes will be coordinated with all involved.

SECTION 2 - PROGRAM ADMINISTRATION

2.0. Objectives

This section sets forth the administrative functions that are necessary to manage the National Maritime Safety Program in an effective and efficient manner. The objectives include:

1. To establish an acceptable level of risk with respect to the operation of EPA vessels by implementing the components of the maritime safety program;

2. To work within the current EPA organizational framework and administrative directives;

3. To define and delegate clear lines of authority and responsibility;

4. To assure compliance with applicable laws and regulations; and

5. To maximize the contribution and participation of administrative and technical EPA staff at all operating levels in developing, implementing, and monitoring the maritime safety program.

2.1 Organization

The Program is administered by Safety, Health, and Environmental Management Division (SHEMD), Office of Administration (OA), and is the vehicle through which the Agency's policy concerning protection of its workers from occupational exposure to accidents and occupational illnesses aboard EPA vessels is effected.

The Program's operational goals also include compliance with applicable federal, state, and local governmental regulations; on-going incorporation of appropriate elements of nationally-recognized consensus standards; and a continuous emphasis on quality and the effective use of the wide range of the national and international expertise available to EPA.

The Program's strategic goals are to incorporate nationally consistent means and methods for identifying, assessing, recording, controlling, and communicating the potential risks and dangers associated with occupational accidents aboard marine vessels.

The organizational structure pertaining to the maritime safety program parallels the format identified in EPA directives for implementing, monitoring, and evaluating occupational safety and health programs within the EPA. As such, the Administrator is responsible for establishing and maintaining an effective Agency-wide safety, health, and environmental management program, including plans for maritime safety.

2.2 Responsibilities

Office of Administration and Resources Management (OARM) at headquarters' level is responsible for management and staff functions such as establishing policy, developing the program plans and procedures, coordinating and providing technical assistance for program implementation, and conducting and overseeing program evaluation. The responsibilities within OARM are further specified as follows:

2.2.1 Assistant Administrator (AA) for Administration and Resources Management (OARM)

The AA for OARM is EPA's designated safety, health, and environmental management official. The AA establishes:

1. Agency-wide safety, health, and environmental management programs, including those for maritime safety;

2.The national program office to direct the development and implementation of an agency-wide maritime safety program;

3.Essential programs and staffing requirements for AAs and Regional Administrators (RAs) to follow in implementing and managing their programs at Headquarters, in the Regions, and in field activities;

2.2.2 Director, Safety, Health, and Environmental Management Division (SHEMD)

The Director of SHEMD directs the development and implementation of agency-wide safety, health, and environmental management programs, including programs for maritime safety. As the national program official, the Director is authorized to:

2.2.2.1 Formulate the agency's policies, programs, plans, standards, protocols, goals, objectives, priorities, and staffing requirements, in accordance with those statutes, regulations, and guidelines identified for an effective National Maritime Safety Program;

2.2.2.2 Coordinate implementation activities of Safety and Health Managers and Environmental Compliance Coordinators;

2.2.2.3 Develop the national Program and documentation to guide implementation within regions and EPA vessels;

2.2.2.4 Provide technical and managerial consultation services for

establishing and maintaining the Program at various operational levels;

2.2.2.5 Develop and maintain administrative support for the Program;

2.2.2.6. Conduct QA/QC activities in order to:

2.2.2.6.1 Assure compliance with the Program;

2.2.2.6.2 Evaluate program effectiveness; and

2.2.2.6.3 Foster continuous program improvement;

2.2.2.7 Collect and synthesize data to document the QA/QC results identified above in & 6.

Primary responsibility for ensuring the successful national implementation and operation of this Program ultimately rests with the Assistant Administrator for Administration and Resources Management. Responsibility for implementation and on-going management of the National Maritime Safety Program at Headquarters and in the Regions rests with the AAs, RAs, and SHEMD.

2.2.3 Office of the Administrator

The Director is responsible for ensuring, within the Office of the Administrator, that:

2.2.3.1 Adequate financial and staff resources are allocated for safety, health and environmental management programs, including the National Maritime Safety Program;

2.2.3.2 Program functions are strategically sited within the Office to ensure effective implementation and management;

2.2.3.3 Delegations of authority for each component of the Program are issued; and

2.2.3.4 Performance standards that parallel and clarify accountability for program performance are established for Office staff.

2.2.4 Regional Administrators

RAs are responsible for:

2.2.4.1 Allocating adequate financial and staff resources for their safety, health, and environmental management programs, including maritime safety programs;

2.2.4.2 Strategic placement of Program functions within the Region to assure effective implementation; and

2.2.4.3 Requiring establishment of performance standards that parallel and clarify accountability for program performance.

2.2.5 Assistant Administrators

AAs are responsible for:

2.2.5.1 Allocating adequate financial and staff resources for their safety, health, and environmental management programs, including maritime safety programs;

2.2.5.2 Strategic placement of Program functions within their organizational units to assure effective implementation;

2.2.5.3 Issuing delegations of authority for each component of the Program; and

2.2.5.4. Requiring establishment of performance standards that parallel and clarify accountability for program performance.

2.2.6 SHEMD Managers

SHEMD Managers are responsible for:

2.2.6.1 Provide direct assistance to AAs, RAs, and other senior management officials in the development, management, implementation, and evaluation of the Program;

2.2.6.2 Assist in assuring that the requirements and program elements of the Program are met; and

2.2.6.3 Implement delegated components of the Program, such as

participating in training programs, coordinating medical monitoring and surveillance functions, participating in quality assurance (QA) functions, and maintaining certain records for QA functions.

2.2.7 Vessel Masters, Operators, and Chief Scientists

Vessel Masters, Operators and Chief Scientists are ultimately responsible for the safety and health of EPA workers on EPA vessels. As such, they are responsible for assuring implementation of the policies, plans, procedures, and quality assurance functions of the Program at reporting units, establishments, or workplaces. They are expected to coordinate to help achieve the expected level of risk with respect to the operation of EPA vessels.

Note: Throughout this manual the term **"Master" and "Operator" should be considered to be synonymous**

The Master or Operator of an EPA vessel has full responsibility for the safety of the vessel and embarked personnel when the vessel is underway. Accordingly, they retain ultimate authority for all underway operations of the vessel. They may terminate any operation when underway if, in the their judgment, conditions endanger the vessel or personnel.

2.2.8 U.S. EPA Vessel Management Official

The U.S. EPA Vessel Management Official is the designated official responsible for oversight of EPA employees on EPA vessels.

SECTION 3 - CLASSES OF EPA VESSELS

3.0 Background

All seagoing vessels are subject to various requirements for documenting their ownership, occupation, and safety. These requirements vary greatly, depending on the size and type of vessel, its employment, the area of operations, etc. In this section, the language of common factors in this process (organizations, laws, etc.) are listed to establish the sources and a baseline for compliance to the safety and environmental pollution control requirements of this manual. The language used herein is chosen to convey the sense of the regulations.

3.1 EPA Vessel Classifications

This manual classifies EPA vessels into three categories (Class A, B, and C). These classifications were selected to group like EPA vessels with regard to fire protection, life saving equipment, manning and the extent of operations undertaken to support mission objectives. Sections of the manual, as appropriate, indicate the applicability of the requirement by Class:

TABLE 3-1 EPA VESSEL CLASSIFICATIONS

VESSEL	CLASS	LENGTH	GT	POWER	BASE LOCATION
OSV Peter W. Anderson	**C**	165’ 00”	250	Twin VT12-875M Diesels1,450 SHP	HQ Annapolis, MD.
R/V Lake Guardian	**C**	180' 00"	283	Twin 16 cyl. Diesels2,250 SHP	Region 5 Bay City, Mi.
S/V Clean Waters	**B**	64' 11"	39	Twin 340 HP Diesels	Region 2 Jersey City, NJ.
R/V HydraNot Operating - In Water	**B**	65' 04"	74.7	Single 850HP Diesel	Region 5 Bay City, Mi.
R/V BluewaterOut of Service - Hauled	**B**	48' 00"			Region 5 Duluth Lab, Mn.
R/V Lake Explorer	**B**	82' 10"	67.5	Twin VT12-900M Diesels1,600 SHP	Region 5 Duluth, Mn.

3.1.1 Class A Vessels

All powered EPA boats under 45', to include those carried on board EPA vessels, berthed at a pier, or carried on a trailer, are classified for purposes of this manual as Class A. In this case, "Class A" is intended to coincide closely with the USCG Class A size designation.

3.2 Involved Organizations

3.2.1 Applicable Organizations

The codes and standards promulgated by the following organizations have applicability in part to all EPA class vessels, and have been reviewed in preparing the EPA requirements set forth in this manual.

United States Coast Guard (USCG): The federal agency authorized by congress under the Department of Transportation with enforcement of laws and regulations concerning ships and seagoing operations.

American Boat and Yacht Council (ABYC): This organization is primarily concerned with private pleasure craft and sets standards for small vessel construction. Some of their standards are referenced in portions of these safety standards and some are incorporated by reference in Coast Guard regulations concerning small craft. The address for obtaining information is ABYC, POB 747, 405 Headquarters Dr., Suite 3, Mellersville, MD 21108-0747.

Federal Communications Commission (FCC): Federal agency charged with the regulation of radio communications, including those to, from, and between ships.

Institute of Electrical and Electronic Engineers (IEEE): A professional group which develops standards in electrical and electronic practices. Many of these are incorporated as legal or prudent requirements for ships. **IEEE 45**: Document issued by IEEE concerning "Recommended Practices for Electrical Installations on Shipboard", provides many good standards in this area; commonly accepted for prudent use.

National Fire Protection Association (NFPA): A professional organization that sets standards for fire fighting equipment and standards for fire prevention. Some of their standards are included in Coast Guard regulations by reference such as those for a National Electrical Code and for pleasure and commercial craft. The address is NFPA, 60 Batterymarch Park, Quincy, MA 02269.

Underwriters Laboratories (UL): A testing and certification laboratory that provides standards and tests equipment for safety. Some of their standards are used in Coast Guard regulations by reference such as those for smoke detectors and commercial cooking exhaust hoods. The address for UL is 333 Pfingsten Rd., Northbrook, IL 60062.

3.2.2 Information

The following organizations are listed for information and for name recognition.

American Bureau of Shipping (ABS): A non-profit organization authorized by the Coast Guard to insure compliance with load line regulations and other related safety factors. The organization provides inspection services to operators for a fee. For vessels "In-classed" by ABS such as the R/V Lake Guardian, ABS performs annual and other periodic hull and machinery inspections, oversight of specific repairs, and overhauls.

International Maritime Organization (IMO): A United Nations agency concerned with, among other things, the establishment of safety standards, pollution regulations, etc. It develops modifications to Safety of Life at Sea (SOLAS) conventions. Although IMO regulations, and as adopted by the USCG apply to commercial international voyage=s for ships 500 GT or more, or passenger vessels carrying more than 12 passengers, some regulations are being accepted by exempt vessel operators because of a universal application, such as the new International Safety Management Code (ISM Code) and the Seafarers Training, Certification and Watchkeeping Code (STCW Code).

Seafarers' Health Improvement Program (SHIP): A collaborative group with membership from ship owners/operators, seafarers, shipping associations, U.S. Public Health Service, U.S. Maritime Administration and the U.S. Coast Guard.

3.3 Laws and Regulations

Code of Federal Regulations (CFR): A compilation of the rules and regulations made by federal, executive departments and agencies, pursuant to the authority of a Federal law. Most material concerning shipping is contained in Title 46 of the CFR. This is divided into chapters and subchapters, of which Subchapter U contains rules for oceanographic vessels. For example, "46 CFR 192" means Part 192 of Title 46 of the CFR.

United States Code (USC): A compilation of the laws of the U.S., generally arranged by

subject matter under "Titles." Shipping laws are primarily contained in Title 46 of the code, which contains the Oceanographic Vessels Acts of 1964. Note that the USC contains actual laws from Congress; the CFR contains agency-generated regulations.

Federal Boat Safety Act of 1971: Act setting forth certain requirements concerning documentation and safety, principally applicable to small craft. (46 USC 527, 46 CFR 24)

International Load Line Act: Act concerning stability standard and Inspections. (46 CFR 42).

Motorboat Act: Federal law enacted originally in 1940 and subsequently amended, which covers many aspects of safety for small craft.

Navigation and Vessel Inspection Circulars (NVIC): Informational material published by the USCG.

Rules of the Road: The statutory and regulatory rules published by the U.S. Coast Guard as COMDTINST M16672.2C, dated 1 October 1995 Navigation Rules governing the navigation of vessels.

Safety Standards for Small Craft: Standards issued by the ABYC concerning safety of small craft. (ABYC D-3-70, H-4-1, H-21-72)

The Seaman's Competency Act and Officer's Competency Act: Set standards for the competency of officers and seamen, and are enforced by the USCG.

3.3 Vessel Types

The following vessel types have applicability in part to all EPA class vessels.

Ship: Often used interchangeably with "vessel", the preferred legal term.

Uninspected Vessel: A vessel not certificated under the inspection laws or subjected to regular inspections by the USCG. Fishing vessels, recreational motorboats, and oceanographic research vessels under 300 gross tons are examples. Uninspected vessels, however, are still subject to rules about safety and, in some cases, licensed personnel. (46 CFR 24).

Public Vessel: A confusing term, having different meanings in various laws and regulations. Under the rules for documenting and inspecting vessels, public vessels are generally defined as those owned or chartered by the U.S. Government and used for public purposes (except those of the U.S. Maritime Administration). Examples are naval ships and EPA vessels. Under federal pollution-control rules, a public vessel is owned, chartered, or operated by the U.S., or by a state or political subdivision.

Undocumented Vessel: Any vessel which is not required to, and does not, have a marine document issued by the USCG. (46 CFR 188.10-75)

Vessel-In-Class: (Applicable to R/V Lake Guardian only) A vessel is said to be "in class" when it holds a current certificate of classification issued by a recognized classification society, such as American Bureau of Shipping, Lloyds, Bureau Veritas, etc. The certificate of classification signifies conformity with prescribed standards of structural strength, machinery, and equipment, providing for seaworthiness and safety in connection with marine insurance.

3.4 Definitions

Master: The designated member of the crew of a vessel who is in charge of the operation of the vessel. The term "Captain" is used almost interchangeably.

Crew: Personnel involved exclusively or primarily in the navigation and operation of a vessel.

EPA Vessel Management Official: The designated official responsible for the safety, health, and environmental protection of EPA employees and their visitors on EPA vessels.

Chief Scientist: The designated member of the scientific personnel who is in overall charge of the research operations and its personnel on-board. The Chief Scientist also has the responsibility of insuring that the scientific party is adequately staffed, and for planning the employment of his/her personnel to ensure unsafe conditions are not generated.

Scientific Personnel: Those persons aboard a vessel solely for the purpose of engaging in scientific research, or for giving or receiving instructions in oceanography or in the support of the EPA's mission. Scientific personnel are considered neither crew nor passengers. (46 CFR 188.10-71. & 46 USC 444)

Passenger: Every person other than the crew or other persons engaged on board a vessel in the business of the vessel. (46 CFR 24.10-23)

Nautical Mile (nmi): The internationally agreed standard sea mile, of 6,076 feet, commonly used in laws, regulations, and treaties for specifying distance at sea or offshore.

Coastwise: Used to describe a route or operating area that is not more than 20 nmi offshore, on any ocean, Gulf of Mexico, Caribbean Sea, Gulf of Alaska, and such other waters as may be designated. (46 CFR 188.10-15).

Ocean: Used to describe an operating area or route in any ocean or the Gulf of Mexico, more than 20 nmi offshore.

Foreign Voyage: A voyage between two countries or between two territories or possessions of the U.S. by a vessel which is not subject to the SOLAS provisions because of its size, propulsion, or documentation. Vessels engaged in such voyages, if 150 gross tons or over that were built before July 21, 1968, or if 79 feet or greater in length and built on or after 21 July, 1968, must comply with load line requirements. After July 1984, existing vessels over 79 feet in length and engaged in a foreign voyage must be measured under the convention measurement system.

Monitor, Surveillance and Research Cruises: Cruise by a vessel primarily for the purpose of conducting marine monitoring, surveillance, and/or research at sea. Commonly defined as commencing on the day of departure and terminating on the day of return to a port.

Operating Day: All days away from home port in an operating status incident to the scientific mission.

Transit: Voyage of a vessel during which little or no research is being carried out; primarily for the purpose of going from one port to another, or to/from a port and an area of research.

Lay Days: Days in port for purposes of fitting out, cruise preparation, crew rest, and upkeep.

Maintenance Days: Days undergoing overhauls, dry-docking, or other scheduled or unscheduled repairs during which the ship is not available for service.

Days Out of Service: Periods in which a vessel is laid up out of service for an extended period for reasons of economy, unemployment, or unfit for service.

SECTION 4 - CHARTERING NON-EPA OWNED VESSELS

4.0 Background

Particular attention should be paid to the safety, material condition, and crew competency of vessels chartered for ocean survey or research. The EPA Vessel Management Official requiring a chartered vessel should utilize the expertise of marine operations individuals to ensure all applicable USCG or State Marine documentation, inspections, and licenses are complete and current. The correction of any deficiencies shall be insisted upon before entering into a charter agreement.

The overall goal is to ensure each chartered vessel meets the same safety standards expected of a comparable size EPA vessel. The EPA Vessel Management Official, responsible for the charter, shall ensure safe, effective operations while operating under charter. In all cases, chartered vessels must comply with USCG or State Marine Laws and Regulations, as applicable.

To help meet this goal, this chapter provides recommended procedures and inspection criteria for the charter of any size vessel.

4.1 Pre-Charter Evaluation

4.1.1 Vessel Background

Collect particulars on the vessel being contemplated for charter so as to have complete data and an understanding of the vessel's safety and capability. Data should include description, radio call sign, owner, operator, licenses, inspections, surveys, safety equipment, communications equipment, and navigation equipment. Investigate any information relative to the stability and watertight integrity of the vessel.

4.1.2 USCG Inspections

4.1.2.1 Greater Than 65 Feet in Length

For vessels over 65 feet in length, require the owner to obtain and carry on board for the time of the charter a USCG letter of designation as an oceanographic research vessel or an appropriate Coast Guard issued Certificate of Inspection. Inspected vessels that possess a current U.S. Coast Guard, SOLAS or U.S. Navy INSURV inspection certificate have been physically inspected by competent marine personnel and such inspections may be used to satisfy this manuals safety objectives. A current inspection is one that has been performed within 12 months of the vessel's charter date.

4.1.2.2 Less Than 65 Feet in Length

If the vessel is less than 65' in length, it would not need to be inspected and could carry up to six passengers. If it carries more than six passengers it would need to be inspected. Small vessels, carrying less than six passengers, that possess a current U.S. Coast Guard

safety inspection performed under the Federal Boating Safety Act of 1971 or the Commercial Fishing Industry Vessel Safety Act of 1988, may also satisfy this inspection requirement if these safety requirements are considered sufficient for the expected area of operation and mission by the EPA Vessel Management Official.

4.1.2.3 Un-Inspected Vessels

If not otherwise USCG inspected, inspect the vessel prior to charter particularly if any questions exist as to vessel's condition, stability or general sea worthiness. Or, if appropriate, request a USCG Auxiliary courtesy examination. The purpose of this inspection is to ensure the proposed vessel meets the requirements contained in this manual and is otherwise suited for the intended purpose. Section C, below, provides a set of guidelines that can be used in conducting these inspections. Discrepancies should be corrected prior to entering into a charter agreement and vessels that do not meet the standards should not be chartered.

4.1.2.4 Charter Crew Qualifications

Conduct whatever inquiry may be necessary to establish the competency of captain, crew, or operator to provide for a safe voyage, including examination of licenses, etc.

4.1.2.5 Charter Approvals

Establish a formal procedure for documenting approvals of charters. Ensure that the Chief Scientist is aware of these, especially the safety-related terms of the charter.

4.2 Recommended Inspection Check List for Chartering non EPA owned Vessels

Check each category listed below as appropriate for the charter mission and operating area. Ensure necessary equipment is aboard and operates properly.

Bridge and Navigation Equipment:

- ☐ Compass
- ☐ LORAN/GPS/OMEGA
- ☐ Depth Sounder
- ☐ Radar
- ☐ Navigation Lights
- ☐ Ship’s Bell
- ☐ Whistle or Sound Device
- ☐ Emergency Alarm
- ☐ Pyrotechnics - Expiration date not exceeded?
- ☐ Navigational Charts and Pubications

Communications Equipment:

☐ Radios, VHF and/or SSB
☐ INMARSAT or Teletype
☐ Cellular Phone
☐ Emergency Radio with backup battery or power
☐ EPIRBs

Documentation:

☐ Ensure vessel can be legally chartered based on certificate of inspection, letter of designation or limitation of charter to less than six persons
☐ Ensure documentation, ownership, inspection certificate, load line certificate and stability letter are current and appropriate for planned mission.
☐ Ensure Master's license is current and appropriate for vessel being chartered.
☐ Ensure crew size and credentials are appropriate for charter's mission
☐ Ensure insurance coverage meets chartering Institute's minimum requirements for charter duration

Life Saving Equipment:

☐ PFDs
☐ Immersion Suits
☐ Inflatable Life rafts
☐ Life Ring Buoys
☐ Rescue Boats

Exterior Decks and Equipment:

☐ Anchors and Associated Equipment
☐ Watertight Doors and hatches
☐ Freeing Ports
☐ Deck vents
☐ Cargo and Weight Handling Equipment (Safe Work Load posted & Tested)
☐ Deck Surfaces Non-Skid
☐ Life Lines and Safety Chains

Fire Fighting Equipment:

☐ Fixed and Portable Fire Extinguishers Inspection Dates Current?
☐ Smoke and Fire Detectors
☐ Fire Stations and Hoses
☐ Self Contained Breathing Apparatus
☐ Fire and Damage Control Locker
☐ Emergency Stations Bill

Engineering

☐ Gas Engines. Check flame arrestor, vents, gas hoses, no sparking devices in bilges
☐ Diesel Engines. Check oil and exhaust leaks, starting system, maintenance, hours since last overhaul.
☐ Inspect overall cleanliness and condition of power sources
☐ Check emergency lights
☐ Check bilge and ballast systems and pumps
☐ Check fueling system and pumps
☐ Check refrigeration systems
☐ Check fire pump
☐ Check engine room fire suppression capability
☐ Check all manifolds for saltwater, fuel, etc

Miscellaneous:

☐ First Aid Kits and Medical Supplies

☐ Damage Control Equipment

☐ Emergency Steering

☐ General Appearance and Cleanliness

☐ Oil Pollution Placard and other required notices are posted

☐ Sanitary System Operations

☐ Assess vessel's overall stability

☐ Assess vessel's overall ability to perform charter mission. Include laboratory and deck space, berthing and feeding capability, scientific equipment and winches, etc.

SECTION 5 - MANNING

5.0 Background

Personnel aboard an EPA research vessel are divided into crew, scientific personnel and passengers. The makeup of the scientific party is governed by the nature of the research work, the size of the vessel and the facilities available on board an individual vessel.

While it varies somewhat from vessel to vessel, basically the scientific party is responsible for carrying out the research, and the crew is primarily engaged in operating the vessel. From the standpoint of safety, it should be noted that there are major differences in the makeup of the crew and the scientific party.

A crew adequate to operate the ship, if necessary around the clock and for extended periods, will be provided - This section sets forth the criteria for that manning.

5.1 Licensed Personnel

USCG licensing of personnel of the crew ensures that they meet minimum levels of competency and experience. The nature and number of licensed personnel is varied, ranging from a single motorboat operator to fully licensed Masters, Mates, and Engineers on EPA Class C vessels. Vessel Management Officials should assure actual competency, either by using licensed personnel, or their equivalent in training, skill and experience based on the needs of the specific vessel.

The need for competency beyond the legal minimum, even on a small day-boat, may also be generated by the nature of the operation, unique features of the vessel, or an intricate research and operational program, and may demand the same skill levels as a much larger vessel.

5.2 Makeup Of Crew

5.2.1 EPA Class C Vessel Crew Requirements

Vessels under 300 gross tons in size, public vessels and uninspected research vessels have no regulatory requirements concerning licensed personnel. However, it is EPA policy that on board Class C vessels, licensed personnel as prescribed in Table V-1 will be required at a minimum.

5.2.2 Class A and B Vessel Crew Requirements

The Master of all EPA Class B vessels, and Class B vessels 65 feet or longer operated by EPA employees, shall have at a minimum, a valid USCG license of Master, or Limited Master of Motor vessels of not more than 100 tons in accordance with the applicable Section(s) of 46 CFR 10. Additional crew members need not hold a valid license or hold a valid USCG Merchant Mariners Document, although it is encouraged. It is the responsibility of the Master to determine

the acceptability of additional crew members with regard to adequate vessel knowledge and to provide training as may be needed and instruction, particularly concerning vessel safety and emergency response.

Operators of Class A and B vessels under 65 feet in length, who are EPA employees, shall conform to the following minimum qualifications as well as those as may be required by the EPA Vessel Management Official.

(1) Be approved by the Vessel Management Official for the operation of the specific type of vessel for which he or she is to be the operator. The approval process should consider total boating experience and required knowledge of the specific craft and the waters involved.

(2) Satisfactorily complete a safe boating course approved by the National Association of State Boating Law Administrators, a public education course conducted by the U.S. Power Squadron of the American Red Cross, a USCG, or USCG Auxiliary approved course.

(3) As appropriate, completion of a First Aid and CPR course in accordance with 46 CFR l0.205(h). The actual need for this training, will be dependent upon the vessel service area, number of people on board and proximity of alternative help as determined by the EPA Vessel Management Official.

5.3 Scientific Personnel Limitations - All EPA Class Vessels

5.3.1 Maximum Allowable

The maximum number allowable aboard, shall be consistent with specific vessel capacity based upon weight distribution, including people, mission specific equipment and duration, particularly on Class A and B vessels, as well as accommodations and related safety issues, available life saving equipment and housekeeping facilities for all EPA Class vessels.

This limit will be established for each EPA vessel and should be made known to prospective chief scientists well in advance, so their staffing can be adequately planned.

Recommended guidelines in this regard are to be found in small vessel manufacturers' specifications, vessel data plates, ABYC publications, the Federal Safe Boating Act, and similar sources.

5.4 Master Of The Vessel

The ship's Master is responsible for the safe operation of the vessel and all of his/her employees. Accordingly, the Master is provided with full authority over all operations and personnel on board ship. To avoid disputes and misunderstandings, the substance of the Master's responsibilities, and concomitant authority, should be clearly set forth in the ship's Cruise Handbook or similar

publication.

The Master and the crew, however, are there solely to facilitate carrying out the research. In practice, the Chief Scientist submits a site safety plan to the responsible program official, and unless it is unsafe or illegal, it will be carried out. If a decision has to be made quickly on the spot, in the interest of safety, the authority of the Master will prevail.

5.5 Chief Scientist

One member of the scientific party shall be designated Chief Scientist. The Chief Scientist is responsible for the coordination and execution of the entire scientific mission. By custom, the personal and professional conduct of the scientific party on board ship and ashore is the responsibility of the Chief Scientist.

In many cases, safety matters are common knowledge, and not unique to research vessels. In other cases there may be safety hazards unique to the research which the ship's crew may not be aware of. In such instances, the Chief Scientist has a special responsibility to assure safety, and consult with the Master as necessary.

5.6 Vessel Organization - Class C Vessels

A vessel specific organization chart or description, shall identify all operating crew positions, lines of authority and a brief description of their duties and responsibilities. This document will be made available to all scientist and passengers planning to ride the vessel. Particular emphasis will be on the Officer positions. This document will also be the basis for all crew member qualifications and training.

TABLE 5-1

EPA CLASS C VESSEL CREWS - MINIMUM LICENSING AND MANNING

POSITION	MIN. USCG LICENSE/DOCUMENT	46 CFR	APPLICABILITY/COMMENTS
Master	1 - Master of ocean or near coastal, motor, 500 GT	10.418	- Applies to all waters including Great Lakes
	- Radar Observer endorsement	15.815	- Applies to all waters
	- Master of Great Lakes & inland, motor, 500 GT	10.446	- Minimum license, restricted to Great Lakes only
	- Great Lakes pilots endorsement	10.701	- Applies to any deck license sailing on the Great Lakes
Chief Mate	1 - Mate of ocean or near coastal, motor, 500 GT	10.420	- Applies to all waters including Great Lakes
	- Radar Observer endorsement	15.815	- Applies to all waters
	- Mate of Great Lakes & inland, motor, 500 GT	10.448	- Minimum license, restricted to Great Lakes only
	- Great Lakes pilots endorsement	10.701	- Applies to any deck license sailing on the Great Lakes
* Mate	1 - Mate of ocean or near coastal, motor, 500 GT	10.420	- Applies to all waters including Great Lakes
	- Radar Observer endorsement	15.815	- Applies to all waters
	- Mate of Great Lakes & inland, motor, 500 GT	10.448	- Minimum license, restricted to Great Lakes only
	- Great Lakes pilots endorsement	10.701	- Applies to any deck license sailing on the Great Lakes
Chief Engineer	1 - Chief Engr., Motor, min HP related to vessel	10.503	- All waters
1st Asst Engr.	1 - 1st Asst. Engr., Motor, min HP related to vessel	10.503	- All waters
	- Alternative, Designated Duty Engineer	10.524	- All waters
* Asst Engr	1 - Asst. Engr., Motor, min HP related to vessel	10.503	- All waters
	- Alternative, Designated Duty Engineer	10.524	- All waters
	- Alternative, Marine Electrician, See Note 1	10.524	- All waters
* Seaman	3 - Merchant Mariners Document, See Note 2	12.05-7	- All waters
	- Alternative, Ship trained & experienced	15.840	- All waters
* Cook	1 - Merchant Mariners Document, Food Handler	12.25-20	-All waters
* Steward	1 - Merchant Mariners Document, Food Handler	12.25-20	-All waters

* Crew position and number is dependent upon three considerations to be determined by the EPA Vessel Management Official for each vessel. (1) Complexity of the ship or operations, (2) The length of any particular cruise which is driven primarily by continuous watch standing requirements (46 CFR 15.705 & 15.710) and, (3) the most effective crew level to maintain the vessel in a planned state of readiness.

SECTION 6 - MEDICAL AND FIRST AID

6.0 Purpose

The purpose of this element is to ensure that EPA vessels, and their embarked crew, are medically qualified for their duties and are prepared to cope with medical issues and emergencies that may arise during the course of operations. The specific requirements are geared to the operations of the vessel.

6.1 Specific Requirements

6.1.1 Personnel Data Form

A "Survey Personnel Data Sheet", shall be required of all scientific survey personnel, including divers for vessels that go to sea overnight, or longer. The forms will be presented to the ship's Master, and will be kept in a locked file in the Master's quarters.

Important note: This form has been designed to obtain information necessary in the event of an emergency while preserving an individual's privacy to the utmost. In the interest of your personal safety and well being, it is vital that someone aboard be aware of any significant medical condition that you may have, which may require the knowledgeable action of someone on-board to assist you.

EPA Chief Scientists, or designated Vessel Safety Officer, shall be responsible for obtaining the "Survey Personnel Data Sheet" form from survey personnel within their area of control. Forms will be presented to the ship's First Mate, and will be kept on file aboard ship.

6.1.2 Vessel Crew Physical Examinations

All crew members shall be required to have an annual physical examination as follows:

All USCG licensed Officers in the Deck and Engineering Departments are required to have and meet specific physical examinations as specified in 46 CFR 10.205, to maintain a valid license.

These same physical standards shall be used as a minimum, for any persons not holding a valid USCG license operating EPA Class B and C Vessels, if the vessel is used for underway tours and/or carries passengers.

All unlicenced crew members that hold a USCG Merchant Mariner's Document (MMD) are required to meet the same physical examination standards as specified in paragraph (1) above per 46 CFR Part 12, Certification of Seaman. Able Seamen must meet the same physical standards as a licensed master, mate or pilot. A Qualified Member of the Engine Department (QMED) must meet the same physical standards as a licensed Engineer.

These same physical standards shall be used as a minimum, for any persons not holding a valid USCG license operating EPA Class B Vessels, if the vessel is used for underway tours and/or carries passengers.

Each Ship Master shall be responsible for maintaining a record of the crew examinations in a locked file in the Master's quarters.

6.1.3 First Aid Training

Medical and safety training is required to ensure that an adequate number of trained personnel are on board EPA vessels at all times to render assistance in any medical or safety emergency.

The following qualification requirements are established for EPA Class B and C Vessels:

For Class C Vessels - Twenty percent of each vessel's crew shall maintain current CPR and First Aid certifications and will comply with the requirements of 46 CFR 10.205 for licensed officers and holders of USCG MMD's for unlicensed personnel.

For Class B Vessels - A minimum of one crew member shall have current CPR and First Aid certifications.

For Class A EPA Vessels, SHEMD strongly encourages Program Managers to ensure that one person is a current CPR and First Aid provider.

6.1.4 Medical Emergencies

This section is intended to provide clear procedures for addressing a serious illness or accident at sea. In the case of personal illness or accident at sea deemed sufficiently serious by the Ship Master (Any EPA Class Vessel) to warrant treatment beyond the first aid facilities on board the vessel, one of the following courses of action shall be taken:

- Survey equipment in the water, if any, shall be immediately recovered and the vessel shall make for the nearest port having adequate medical facilities. The highest possible speed consistent with safety shall be made. Radio contact with the port of arrival shall be made, and dockside clearance with an ambulance standing by shall be requested.

- In the case of an extreme illness or accident, immediate radio contact with the nearest MED-EVAC helicopter facility shall be established and assistance

requested. Any survey equipment in the water shall be recovered, and the vessel shall make the highest possible speed consistent with safety, in the direction of the MED-EVAC helicopter facility.

The vessel shall rig for helicopter operations raft, and continuous radio contact shall be maintained with the helicopter base and/or the incoming helicopter.

- All EPA vessels that embark on overnight, or longer voyages are encouraged to establish procedures with a medical facility ashore for obtaining medical advice via radio or telephonic means in the event of a medical emergency.

- In the case of a diving emergency, refer to the section of this manual on diving and confer with the on-board Dive Master.

6.1.5 Medications and Medical Supplies

An onboard supply of medications and medical supplies is required for the treatment of injuries and non-emergency sicknesses. This section provides recommendations and guidance to meet this need:

6.1.5.1 First Aid Kit For Class C and B Vessel

Instructions for the use of first-aid supplies should be listed in legible type on a durable surface and securely attached to the inside of the cover. The following kit contents are recommended - Contents should be adjusted, as necessary based on the geographical location and the operations carried out on the vessel:

Item	Number recommended
Bandage compress-4"	5
Bandage compress-2"	8
Waterproof adhesive compress-1"	32
Triangular bandage-40"	3
Eye dressing packet, 1/8 ounce	
Ophthalmic ointment, adhesive strips, cotton pads	3
Bandage, gauze, compressed, 2" x 6 vas.	2
Forceps	1
Scissors	1
Safety pins	12
Wire splint	1
Ammonia inhalants	10
Iodine applicators, 1/2 ml swab	10

Aspirin, Phenacetin and caffeine compound, 6 1/2 gr tablets, vials of 20	5
Sterile petroleum gauze, 3" x 18"	7
Trauma Dressing	5

This first aid kit is woefully inadequate for any traumatic event on a ship

6.1.5.2. First Aid Kit For Class A Vessels

A small, commercially available first aid kit will be carried on all EPA Class A vessels. Contents should be appropriate to the geographical location and the operations carried out on the vessel.

6.1.5.3 Non-Prescription Medicines

In addition to the first aid kit(s) described above, Class C Vessels, and Class B Vessels on overnight or longer cruises, should maintain a supply of non-prescription medications and medical supplies, in a readily accessible location. The medical cabinets must be updated every month and shall be well-organized. Expired medications must be disposed of immediately. A list of contents, and any necessary instructions must be posted inside the medical cabinet door.

The Vessel Master or First Mate, if assigned, is responsible for replenishing stocks, discarding expired medications, updating listings, posting use instructions and keeping the cabinet well organized.

The following inventory of Non-Prescription Medicines is recommended:

Type of Illness/Injury/Complaint	Medication
Aches/Pains	Aspirin tablets Extra-strength Tylenol tablets Flexeril tablets Advil tablets
Acid Indigestion/Upset Stomach	Kaopectate solutions Donnagel solution Mylanta solution/tablets Maalox liquid Rolaids tablets Pepto Bismol liquid/tablets Lomotil tablets

Cold Remedies	Chloroseptic gargle Cepacol throat lozenges Contact capsules Coricidin capsules Triaminicin capsules Drixoral capsules/tablets Dristan capsules/tablets Alka-Seltzer Plus tablets Benylin expectorant Vicks Vapor Rub Cough calmers
Cold Sores/Cuts	Camphophenic liquid
Constipation	Milk of Magnesia solution
Eye Solutions	Eye pads Eye irrigation solutions Normal saline solution Neosporin ophthalmic ointment
Motion sickness	Dramamine tablets
Scrapes/Minor cuts	Alcohol preparation
Burns/Splinters	Neosporin ointment Bacitracin ointment A&D ointment Caladryl ointment Water gel dressing Iodine liquid Betadine wash NOT AVAILABLE Hydrogen peroxide
Type of Illness/Injury/Complaint	Medication
Skin problems	Petroleum jelly Polysporin salve Tinactin salve
Sprains/Strains	Head dressings

	Ace bandages Cold packs Ben-Gay ointment Arm and leg splints
Bandages/supplies	Band-Aids Telfapads Cotton balls Kling 3" and 4" bandages Adhesive tape 4x4 dressing Scissors Tweezers
Miscellaneous	Ammonia inhalant Isotonic saline solution Suction machines

6.1.5.4 Prescription Medication

In addition to the non-prescription medicines described above, Class C Vessels, and Class B Vessels on overnight or longer cruises, should maintain a supply of prescription medications suitable to their operation and location. All prescription medications shall be kept in a locked box in the vessel Master's quarters. The vessel's Master is responsible for inspecting medical supplies on a monthly basis and disposing of expired medications immediately. Any use of prescription medications must be under medical supervision, which can be received through the Coast Guard. The vessel's Master must authorize the use of any prescription medications, and any authorization and use shall be documented in the deck log by the vessel's Master. A medical doctor's approval is required for obtaining and stocking prescription medicines - The following list is offered as a suggestion for EPA vessels:

Type of Medication	Generic Name
Analgesic	Ibuprofen, 600 mg Darvocet N, 100 mg Tylenol with codeine
Anaphylactic (bee sting)	Epinephrine/Ag-adrenalin

Anti-asthmatic	Metaproterenol sulfate, inhalation aerosol
Antibiotic	Amoxicillin, 500 mg Erythromycin, 250 mg
Anti-motion sickness	Meclizine ICl, 25 mg Promethazine HCl, 25-50 mg
Coronary vasodilators	Nitroglycerine 0.4 mg Nitroqual spray
Sedatives	Phenobarbital, 32 mg
Urinary problems	Pyridium tablets, 100 mg

The section on Prescription Drugs (Scheduled Drugs) is problematic. Civilian vessels, whose medical care is not provided by Public Health Service Physicians(USGC/USPHS), operate under the medical license of a civilian physician, if so assigned. Most do not have civilian physicians on board. Scheduled drugs/controlled Substances, are prescribed by a licensed physician and administered by a trained surrogate, i.e., civilian EMT-Paramedic, nurse, nurse practitioner, physician's assistant etc. It too, is unlikely that any of these providers are on board. Given that it is unlikely that either of these two levels of providers are on board at any time, the value of storing these drugs is very limited, and the potential use minimal. Scheduled drugs are dated and according to the FDA must be inventoried and replaced at specified interval. None of the drugs listed are considered emergency drugs except nitroglycerine(cardiac vasodilator) and epinephrine(anaphylaxis) and are of limited value, in the emergency setting. Most of these drugs are for long term disease processes.

ENVIRONMENTAL PROTECTION AGENCY

INSERT NAME/NUMBER OF VESSEL

SURVEY PERSONNEL DATA SHEET

Name_____Phone_____

Home Address_____

Mailing Address_____

Z or License

Rating_____License Held_____No._____

SS# _____Date of Birth _____Place_____

Blood Type_____ Medic Alert Tag?(Y/N)_____Last Tetanus Shot_____

Physician's Name_____ Phone _____

Date and Place of Last Physical Exam_____

Height_____Weight_____Eye Color_____Hair Color_____

Contact Lenses (Y/N)_____ Allergies_____

Current Medication_____

Other Relevant Medical Considerations_____

_____

Your Typical Blood
Pressure Reading_____ Scars or Marks_____

In Case Of Emergency, Notify:

Name_____Relationship_____

Address_____

2 Phone Number_____

(Privacy act notice - insert here)

SECTION 7 - FIRE PROTECTION - CLASS C AND B VESSELS

7.0 Applicability

This section is applicable to, and mandatory for, all Class C EPA vessels. EPA Class B vessels should be assessed with respect to their operations (Laboratories, Amount of Hazardous Materials On-Board, etc.) and those portions of this section deemed necessary to achieve an acceptable level of risk, as determined by the Program Manager, should be adopted for those vessels. Class A vessels follow USCG rules for the type and size of the involved vessel.

Vessels that do not operate continuously throughout the year need not fully comply with the listed requirements while the vessel is in winter lay-up. Prior to resuming active operation, it is the Master's responsibility to verify that all aspects of the fire protection program are functionally tested and found to be in operable condition. It is also the Master's responsibility to verify that all aspects of the fire protection program are functional and are in operable condition following any extended shipyard work.

7.1 Responsibilities

It is the Vessel Management Official's (VMO's) responsibility to ensure that the fire protection program is operational at all times the vessel is in active service. All fire extinguishing systems and fire alarm systems must be functional as demonstrated through current testing by a qualified agency within the required service intervals.

If the vessel is at sea and any fire protection equipment becomes disabled, it is the Master's responsibility to enact interim compensatory measures until the equipment can be repaired. The Master should determine the appropriate type and level of remedial actions necessary. If, in the opinion of the Master, an unsafe condition exists the vessel shall immediately proceed to port.

On the occasions when the Master temporarily leaves the vessel, a senior officer shall be pre-designated to be in responsible charge of the fire protection program until the Master returns to the vessel.

In case of a medical emergency that incapacitates the Master during a fire event, the senior officer aboard the vessel shall automatically assume control of the program.

7.2 Fire Fighting Responsibilities

7.2.1 Training requirements

All licensed crew members must have completed the U.S. Coast Guard required fire fighting training specified for their grade of license. Each licensed crew member must possess a current Fire Fighting Certificate from a U.S. Coast Guard approved fire training academy. All other crew personnel are encouraged to participate in voluntary fire school training programs that are available through State and local programs.

The vessel's crew needs to conduct regular fire drills in order to function effectively as a team and to retain their necessary fire fighting skills. It is the Master's responsibility to ensure that weekly fire and boat drills are carried out in accordance with U.S. Coast Guard regulations.

To ensure that effective drills are conducted, they should be pre-planned to allow critical review of the fire control team's performance. A post drill critique should be conducted to allow free interaction of ideas and provide improvements to the crew's fire fighting abilities. The subject matter and location of the drills should be varied to include practical exercises in all shipboard areas during a one year period. The following subject areas are a suggested guideline of drill topics that may be covered in an annual training cycle. Vessel specific hazards may require drills in specialized hazards:

- Fire control team notification procedures
- Fire control team communications procedures
- Fire behavior
- Controlled application of water to vessel fires
- Use of portable fire extinguishers
- Use of hoses and nozzles
- Use of fire fighting foam
- Knots and ropes
- Use of SCBA
- Use of ladders
- Forcible entry techniques
- Co-ordination with port fire departments
- Rescue techniques in below-deck spaces
- Ventilation and smoke removal techniques
- Fire fighter safety
- First aid & CPR
- Fires involving hazardous materials
- Co-ordination of fire fighting procedures with vessel operating and emergency procedures.
- Pre-fire planning
- Fire fighting techniques when normal suppression equipment is obstructed or inoperable.
- Fire fighting techniques "at sea" versus in port
- Operation of installed fire extinguishing systems

Additional guidance on fire fighting training may be obtained from:

National Fire Protection Association
One Batterymarch Park
Quincy, MA 02269

International Fire Service Training Association
Oklahoma State University
Stillwater, OK 74078

Federal Emergency Management Agency
National Fire Academy
16825 South Seton Ave.
Emmitsburg, MD 21727

7.2.2 Fire Fighter Personal Protective Equipment

Every EPA Class C Vessel must maintain onboard a minimum of two complete sets of protective equipment to allow effective fire fighting operations. Due to height and weight differences between crew members, it may be necessary to have additional sets of equipment to ensure that all crew members have access to equipment of the appropriate size. The need for additional sets of equipment will be determined by the Master, based on the specific conditions aboard the vessel. Each set of protective equipment must include:

- Helmet (NFPA 1972);
- Gloves (NFPA 1973);
- Self contained breathing apparatus (NFPA 1981);
- Protective coats and pants (NFPA 1971);
- Face shields or approved eye protection;
- Rubber boots or approved footwear (NFPA 1974);
- Nomex hoods or approved ear protection;
- Flashlight.

The NFPA references listed above provide additional information on the type of equipment recommended. When purchasing equipment, the supplier must certify that the equipment complies with the listed NFPA standards.

All personnel must be familiar with the use and care of the protective equipment through regular practice. The equipment must be kept clean and maintained in good repair in accordance with the manufacturer's instructions.

7.2.3 Fire Fighting Equipment

In addition to the required fire fighters personal protective equipment, each EPA vessel must carry an adequate supply of tools and equipment to facilitate fire fighting operations. This equipment does not have to be special purpose equipment specifically dedicated for fire fighting, as regular maintenance tools could be used. Each vessel may have differing needs due to the level of hazard present, however, possible necessary equipment includes:

- Portable lighting equipment, either hand held battery lights or cord connected lighting units powered from an emergency power source;
- Fans or blowers for smoke remova;
- Portable pumps for dewatering;
- Ropes;
- Safety harnesses;
- Forcible entry tools such as axes, pry bars, or bolt cutters;
- Portable ladders;
- Portable radios.

The existing EPA Class C Vessels are in the 250-299 gross ton range and each will be equipped with four fire axes that are dedicated for use by the fire control team.

The fire axes should be distributed throughout the vessel and mounted where they are available for ready use. Suitable safety guards or covers should be provided over the exposed ax pick heads.

7.2.4 Fire Notification and Evacuation Procedures

Each EPA vessel must develop a specific procedure for crew and passenger actions to be taken when a fire is discovered. The procedure must be developed by the Master with assistance from the Ship Safety Officer, if one is assigned. All crew members and passengers must be trained on this procedure when embarking on the vessel for the first time. A generic format that may be used to develop a vessel specific list of actions is presented below:

ACTIONS TO BE TAKEN UPON DISCOVERY OF FIRE

All personnel upon discovery of a fire shall take the following actions in the listed order unless conditions warrant a different course of action:

1. Determine if any personnel are injured or trapped by the incident.

2. Determine if you are able to assist trapped or injured individuals. If you are alone, make all attempts to remove the individuals to a safe location. If you are with other persons, immediately send one person for help while you attempt to rescue the trapped individuals.

3. Evaluate the size of the fire. If it is a very small fire, attempt to extinguish it with a portable fire extinguisher.

4. If you are unable to assist injured individuals or if the fire is substantial, immediately call for help. If you have a radio call the bridge and describe the situation. If you do not have a radio find another means of communicating with the bridge.

5. Leave the fire involved area and proceed to a safe area.

6. Sound the alarm from a manual pull station.

7. Follow the instructions of your station bill, or proceed to the emergency assembly area.

Each EPA vessel must develop a standard response procedure for crew actions to be taken when a notification of fire is sounded. The fire control team should assemble at a pre-determined location. Usually this will be a control station such as the navigating bridge or the fire equipment locker. The location should allow the fire control team to communicate directly with the Master or Mate on watch to decide if any vessel maneuvers will be necessary to allow more favorable conditions for fire fighting.

In response to a fire alarm, all persons onboard that do not have a station bill (emergency duties) assignment should assemble at a pre-selected location when the fire alarm is sounded. At sea, this location would generally be the lifeboat or life raft embarkation station. In port, a different emergency assembly location should be selected that allows convenient access to the gangways. The purpose of this is to allow a determination of whether all persons are safely accounted for.

7.2.5 Visitors

EPA vessels that carry visitors at sea or that allow public group tours while in port shall develop specific emergency evacuation procedures to safely account for and rescue these persons in a fire emergency.

When public tours are brought aboard the vessel, the exit procedures shall be tailored to the increased occupant load. The existing means of egress aboard vessels are designed to move the occupants up to the lifeboats and may be inadequate to promptly evacuate a large number of visitors down to the dock.

The procedures shall specifically address the:

- Presence of deck obstructions such as mooring chocks and cleats that could impede egress;
- Adequacy of aisle and stairway widths;
- Location and number of gangways that provide access to the dock;
- Potential presence of disabled persons and small children.

7.3 Fire Control Plans

All Class C vessels shall have permanently displayed fire control plans. The fire control plans shall consist of general arrangement drawings for each deck that clearly show the fire retardant bulkheads together with particulars of the fire detecting, manual alarm, and fire-extinguishing systems, locations of fire doors, and means of egress for each area. The plans shall also include details of the ventilating systems, including the positions of dampers and the location of the remote means of stopping the fans, and identification of fans serving each section.

It is also recommended that a copy of the fire control plans be provided to the local fire department in the vessel's home port, and another kept in a conspicuously marked, weather tight, on-deck container.

7.4 Quality Controls

7.4.1 Use of Approved Materials and Equipment

Only USCG approved fire protection systems and equipment may be used aboard EPA vessels. The U. S. Coast Guard has extensive testing requirements to ensure that installed equipment will continue to operate properly after exposure to the vibration and corrosion associated with the marine environment. If additional excess fire protection equipment is carried aboard an EPA vessel, it must also be of an approved type. This is to ensure that substandard equipment is never relied on in emergency situations. All replacement parts and repairs to the fire protection systems must be approved original equipment.

Electrical components must be U. S. Coast Guard approved or UL approved Marine Products. This is to prevent electrically initiated fires. The USCG Electrical Engineering Regulations (Subchapter J, 46 CFR 110-113) contain information regarding shipboard wiring practices that must be followed in all cases when installing new equipment or making modifications.

It is also important to note that electrical equipment (starters, alternators, distributors, etc.) installed on gasoline powered engines is specially designed to prevent the ignition of gasoline vapors. Gasoline vapors are heavier than air and will accumulate in lower deck areas and in the bilges. Anytime repairs are made to gasoline engines or auxiliaries, the replacement parts must be UL approved Marine Grade components. Gasoline powered engines must also have an approved flame arrestor installed on the carburetor air intake.

7.4.2 Record Keeping

It is important that adequate records are kept of modifications and the servicing and maintenance of fire protection systems and equipment. The Chief Engineer shall be responsible for determining which records are important for the upkeep of the vessel's fire protection systems. Original blueprints should be available for all installed fire protection systems. Anytime modifications or repairs are made to installed systems or structures, the work order must require that adequate documentation or drawings are provided so that future inspections will have access to the updated information. The drawings are also useful because the manufacturer's part numbers for each piece of equipment are listed, providing a ready reference for ordering replacement parts.

A file must be kept that includes copies of all system testing and maintenance reports. If any fire protection systems are tested by the vessel's engineering staff, a report or checklist showing the items tested, a simple description of the test procedures, whether or not the tested item passed or failed the test, and recommended corrective actions must be prepared and kept on file. The file shall be periodically reviewed by the Chief Engineer to verify that necessary corrective actions are being completed in a timely manner. The time interval for this review is semi-annually or at the beginning of each year's sailing schedule, after the winter lay-up.

All fire drills and related fire fighting training must be pre-planned and post critiqued. It is recommended that a file, separate from the ship's logbook, be kept of all such exercises. The file must include a description of the exercise and the names of all of the participants.

7.4.3 Operational Procedures

7.4.3.1 Minimum Required Equipment

Each EPA vessel shall adopt operational procedures to define the required minimum fire protection systems and equipment that must be operational before the vessel is allowed underway. All required fire protection equipment must be fully operational at all times. In special circumstances, however, it may be necessary to operate the vessel before repairs to non-functional equipment can be completed. If, in the opinion of the Master, the vessel can still be safely operated with the fire protection systems partially inoperable, the mission can proceed. The Master and the Chief Engineer should develop these guidelines based on the specific equipment and hazards aboard the vessel. General guidance for the development of realistic criteria are provided below:

System	Minimum Required Equipment
(1) Fire Main System:	• At leastt one fire pump functional.
	• Sufficient hose outlets on each deck so that all areas can be

reached through not more than 100 feet of interconnected hoses.

- System tested within required interval.

(2) Fire Alarm System:

- At least one manual pull station per deck functional
- Sufficient alarm bells or horns functional to be audible in all areas.
- Smoke detectors (if provided) in all high hazard areas are functional.
- System tested within required interval.

(3) Portable Fire Extinguishers:

- At least one extinguisher available within 75 foot travel distance in all laboratories, machinery spaces, or other high hazard areas.

(4) Specialized Extinguishing Systems:

- All systems protecting the main engine room and auxiliaries fully functional.
- Systems tested within required interval.

(5) Emergency Lighting:

- Sufficient lighting units functional to allow emergency evacuation from all areas.

7.4.3.2 Testing and Maintenance Procedures

Each EPA vessel must develop procedures that contain the necessary information for the testing and inspection of all vessel fire protection systems. This will ensure that the systems will be ready for use at all times and that all equipment provided is maintained and replaced after use or repairs. The procedures must include checklists that are completed for each inspection. The checklists should detail the extent of the inspection made and the checklist must be signed by the person performing the inspection when the inspection is completed. These checklists must be retained on file to serve as a record of the testing performed on the fire protection systems.

The recommended procedures for the testing of the various systems and their frequencies have been taken from U.S. Coast Guard regulations and NFPA Standards. The criteria applicable to the fire protection systems has been developed

from the following:

- 46 CFR Part 189 - Oceanographic and Research Vessels
- NFPA Standards -NFPA 10 - Fire Extinguishers, Portable
- NFPA 20 - Fire Pumps, Centrifugal
- NFPA 14A - Standpipe and Hose Systems, Inspection, Testing, and Maintenance
- NFPA 12 - Carbon Dioxide Extinguishing Systems
- NFPA 17A - Wet Chemical Extinguishing Systems
- NFPA 17 - Dry Chemical Extinguishing Systems
- NFPA 72H -Testing Procedures for Local, Auxiliary, Remote Station, and Proprietary Protective Signaling Systems
- NFPA 101 - Life Safety Code (emergency lighting)

The frequency of inspections must be based on the guidelines provided below. Vessels that are in lay-up for a portion of the year may adopt an inspection frequency that is more compatible with their operational schedule. Monthly and annual or semiannual inspections shall be performed as indicated below. The monthly inspections are intended to be performed by shipboard personnel, while the annual inspections are expected to be performed by a qualified third party. If there are qualified persons on the vessel's crew, the annual inspections may be conducted in-house. Recommended service intervals and generic procedures for the inspection of typical equipment are provided in the following sections:

7.4.3.2.1 Fire Pumps, Fire Main, Hose Stations

(a) Monthly Inspection: The fire pumps, fire main, and hose stations shall be inspected monthly, or at approximately 30 day intervals, by shipboard personnel. The following areas shall be checked:

- Test each fire pump on a staggered basis. Start the pump and operate on recirculation or flow through a convenient outlet. Operate the pump for at least 10 minutes and check for abnormal conditions such as noise, vibration, or leakage.
- Visually observe each valve on the fire main and verify that the valves are sealed in the correct position.
- Inspect each fire hose station and verify that:

  The gate valve is closed
  The valve handle is present
  The hose and nozzle each have a gasket in place
  The hose is present and not damaged or mildewed
  A spanner wrench is present

The nozzle is present and the open/shut handle operates freely
There are no visible signs of leakage

(b) Annual Inspection: At least annually the following tests shall be conducted by qualified shipboard or contractor personnel:

- The fire pumps shall be flow tested to determine that each is capable of simultaneously flowing the two highest outlets at a nozzle pressure of 50 psi through single 50 foot lengths of hose and 1/2 inch diameter nozzles.

- Each length of fire hose shall be hydrostatically tested to the maximum pressure it is subjected to, but not less than 100 psi. The test shall verify that the hose does not leak and that the couplings are not loose.

- The fire main shall be flushed by flowing each outlet for at least five minutes or until clean water appears.

- Each valve in the fire main shall be cycled through a complete open-close cycle. The valves shall be returned to their correct position after the test.

7.4.3.2.2 Fire Detection and Alarm System

(a) Monthly Inspection: The fire detection systems shall be inspected monthly, or at approximately 30 day intervals, by shipboard personnel. The inspection shall cover the following areas:

- The "Power On" indicator lamp on the main control panel shall be illuminated.

- No trouble lamps or alarm lamps shall be illuminated.

- The control panel Lamp Test switch shall be depressed to verify that all lamps are functional.

- No obvious damage, disconnected wires, or altered circuits shall be evident.

- Randomly activate a device to ensure system functions and alarms are audible in the vessel.

(b) Semi-Annual Inspection: At least semi-annually, have the system

serviced by a qualified service contractor. The inspection shall include the elements specified by NFPA 72H.

7.4.3.2.3 Portable Fire Extinguishers

(a) Monthly Inspection: All extinguishers shall be inspected monthly, or at approximately 30 day intervals by shipboard personnel. The monthly shipboard inspections shall include the following areas:

- The extinguisher shall be verified to be at its designated position and in the hanger or bracket provided. The bracket must securely hold the unit.

- The extinguisher must be verified to be visible and readily available. Access to the extinguisher must not be obstructed by trash, storage, or other items.
- The operating instructions on the nameplate shall be legible and facing outward.
- The safety pin and tamper indicators shall be in place and shall not be broken or missing.
- Verify the extinguisher has not been discharged by either lifting the unit to judge its weight or by checking the pressure gage.
- Examine the unit and verify that there is no physical damage, corrosion, leakage, or clogged discharge nozzle.

(b) Annual Inspection: At least annually, the fire extinguishers shall be serviced by a qualified outside service agency. The annual inspection shall include the elements specified for maintenance by NFPA 10.

7.4.3.2.4 Carbon Dioxide Systems

(a) Monthly Inspection: Installed carbon dioxide systems shall be inspected monthly, or at approximately 30 day intervals, by shipboard personnel. The inspection shall cover the following areas:

- The cylinders shall be verified connected to the manifold and securely mounted;
- The control cylinders, control valves, and discharge delay device shall be verified to be in position with locking pins and tamper indicators in place and sealed;
- The system release handles shall be verified in place with operating instructions present;
- The manual pull cables and conduits between the system releases shall be verified in good operating condition and connected to the

valve operators;
- System nozzles in the protected area are not damaged, clogged, or obstructed.

(b) Annual Inspection: At least annually, have the system serviced by a qualified service contractor. The inspection shall include the elements specified by NFPA 12. The inspection shall include check weighing of the cylinders. The cylinders shall be recharged if a weight loss of more than 10% of the marked agent weight occurs.

7.4.3.2.5 Emergency Lights

(a) Monthly Inspection: The emergency lighting units shall be inspected monthly, or at approximately 30 day intervals by shipboard personnel. The inspection shall cover the following areas:

- The test switch on each unit shall be depressed for at least 30 seconds. The lamps shall illuminate, and the charge indicator shall momentarily indicate rapid charge.
- Verify that the lamps are aimed to illuminate the exit path.

(b) Annual Inspection: At least annually the following test shall be conducted by qualified shipboard or contractor personnel:

- Perform a deep cycle discharge test of each lighting unit by unplugging it from its outlet. The emergency lights shall remain illuminated for a period of 1-1/2 hours. If the lamps do not remain illuminated for the full 90 minutes, the batteries shall be replaced.

7.5 General Fire Prevention Training

All personnel must be provided with general training instructions on fire prevention when embarking on the vessel for the first time. The instructions should either consist of a brief training exercise or self review of a written lesson. The training should include a review of the vessel's specific policies concerning:

- Control of combustible materials
- Control of ignition sources
- Allowable smoking areas
- Special requirements during fueling operations
- Safety precautions when operating gasoline powered equipment
- Safety precautions in CO_2 protected areas
- Handling flammable and combustible liquids
- Fire reporting procedures

- Response to fire alarm signals
- Laboratory fire safety

7.6 Marking of Fire Protection Equipment

All required fire protection equipment must be readily identifiable. The criteria for markings are contained in the USCG regulations listed in 46 CFR 196.37. It is recommended that all fire protection system piping be painted red to make it easily identifiable. The requirements for the permanent marking of specific fire protection equipment are summarized below:

7.6.1 Carbon Dioxide Alarms

All carbon dioxide alarms shall be conspicuously identified: "**WHEN ALARM SOUNDS --VACATE AT ONCE. CARBON DIOXIDE BEING RELEASED**."

7.6.2 Extinguishing System Valves

The branch line valves of all fire extinguishing systems shall be plainly and permanently marked indicating the spaces served.

7.6.3 Extinguishing System Controls

The control cabinets or spaces containing valves or manifolds for the various fire extinguishing systems shall be distinctly marked in conspicuous red letters at least 2 inches high: "**CARBON DIOXIDE FIRE APPARATUS," or "FOAM FIRE APPARATUS**," etc. as appropriate.

7.6.4 Fire Hose Stations

Each fire hose station shall be identified in red letters and figures at least 2 inches high, "**FIRE STATION NO. 1, 2, 3**, etc."

7.6.5 SCBA

Lockers or spaces containing self-contained breathing apparatus shall be marked: "**SELF CONTAINED BREATHING APPARATUS**."

7.6.6 Fire Extinguishers

Each portable fire extinguisher shall be marked with a number, and the location where it is stowed shall be marked with a corresponding number at least 1/2 inch high.

7.6.7 Emergency Lights

All emergency lights shall be marked with a letter "E" at least 1/2 inch high.

7.7 Control of Ignition Sources and Combustible Materials

7.7.1 General Storage Practices for Ordinary Combustible Materials

Each EPA vessel must develop programs and operating practices to minimize potential fire hazards due to the storage and use of ordinary combustible materials such as wood, paper, and cardboard, as follows:

- Ordinary combustible materials must not be stored in areas where flammable liquids or chemicals are stored.
- Large quantities of combustible materials must not be kept onboard unless required by the scientific mission.
- Whenever equipment is unpacked, all shipping crates, packing materials, and dunnage must be promptly removed from the vessel.
- Whenever work is being performed onboard the vessel resulting in the creation of scrap materials and debris, these materials must be collected and removed at the end of each day's workshift.
- Whenever quantities of ordinary combustible materials are required, they must be stowed in a central location that has fire detection capability or is protected by an installed extinguishing system. On-deck stowage should be considered if possible.
- Cobustible materials must not be stored in an area where they could come into contact with heated surfaces. This consideration should include engine exhaust trunks, boiler and galley uptakes, laboratory fume hoods, and laboratory areas where open flames could be used.
- Temporary structures, room partitions, and laboratory enclosures should be constructed of non combustible materials or materials of limited combustibility if possible.

7.7.2 Storage Practices for Hazardous Materials

7.7.2.1 Definitions

Hazardous materials are considered to be any combustible or flammable liquid, gas, or chemical. The exact basis for the definition of these materials can be found in NFPA 30. Generally, the basis for classification of the materials is defined as follows:

Combustible liquid - A liquid having a flash point at or above 100/ F. (37.8/C)

Flammable liquid - A liquid having a flash point below 100/ F. (37.8/C)

Flammable gas - A material that exists in a gaseous form at room temperature and

will burn in combination with air or oxygen.

Non-flammable gas - A material that exists in a gaseous form and will not burn in combination with any amount of air or oxygen. This category generally includes two subsets; inert gases and oxidizers. Oxidizers themselves do not burn, but can cause the enhanced combustion of other materials.

7.7.2.2 Procedures

Certain of these materials are needed as fuels or lubricants to operate the vessel's machinery. Others are necessary for operation of the laboratories. For either application, each vessel must develop, and implement safe handling and use procedures. General guidance for the content of these procedures is provided below:

7.7.2.2.1 The use of hazardous materials for vessel machinery

Diesel fuel and similar combustible liquids are normally stored in bilge tanks or day tanks, and as such present a limited fire hazard. Any spills due to overflows or leakage must be promptly cleaned up. Flammables such as lubricants, aerosol sprays, and solvents must be kept in an approved flammable liquids storage cabinet in or near the engine room. If any of these materials are removed from the approved storage cabinet for day to day equipment maintenance, they should be returned at the end of the workshift. If any gasoline powered equipment is used onboard, the gasoline reserves must be stored in approved flammable liquid cans kept inside an approved cabinet. Alternatively, on-deck stowage of the gasoline is acceptable.

Paints and solvents used for the upkeep of the vessel must be stored in an enclosed paint locker, preferably in an on-deck location away from the accommodations areas. The paint locker must be separated from adjacent areas by steel bulkheads and decks. Ordinary combustible materials must not be stored in paint lockers.

Flammable gas cylinders must not be stored in occupied areas. Whenever flammable gas cylinders are used, they must be securely fastened to prevent their physical damage due to vessel movement. Cylinders not connected to a manifold or piece of equipment must have their safety caps in place. Empty cylinders must be stored separately from full cylinders.

7.7.2.2.2 The use of hazardous materials in chemical laboratories

Flammable and combustible liquids used in the laboratories must be restricted to the quantities needed for the experiments being conducted. Larger quantities of flammable and combustible liquids must be kept in

approved flammable liquid storage cabinets located within a protected chemical storage room. Additional information on the safe laboratory use of flammable chemicals can be found in NFPA 45.

7.7.3. Cutting and Welding

Each EPA Class B and C vessel must develop procedures and operating practices to govern the safe performance of hotwork operations. Detailed guidance on this issue is contained in NFPA 51A. A welding permit system shall be developed for each vessel, either by the crew or by the organization responsible for vessel maintenance. Before any hotwork operations commence, it shall require the Master's permission or a responsible person designated by the Master. A suggested generic welding permit format is listed below. The second page of the permit contains general fire safety precautions that as a minimum must be addressed. These precautions should also be used if welding is required on an EPA Class A vessel.

If a confined space is involved - See Safety section of this manual.

HOTWORK PERMIT

Date:

Work Location:

Description of Work:

Special Precautions:

Is Fire Watch Required?

Hotwork Permit Checklist Completed?

Permit Expires:

Signed:

Time work begun: **Time completed:**

==========

Final Inspection

The work area, and areas below, above, and behind the work area have been inspected for evidence of fire spread 30 minutes after the completion of the work. No charring, smoke, or other evidence of fire spread were observed.

Signed:

HOTWORK PERMIT CHECKLIST

Before any hotwork operations begin, the Master or a designated person shall complete this checklist and confirm that conditions are acceptable to begin work.

General Precautions

- □ Fire suppression or detection is in service
- □ Cutting and welding equipment is in good repair

Within 35 feet of work area

- □ Decks swept clean
- □ Combustible deck coverings covered with metal
- □ No combustible materials or flammable liquids present
- □ Combustible structure or interior wall finishes covered with metal
- □ All bulkhead and deck openings covered
- □ Non combustible covers suspended beneath work to collect hot sparks

Work on Bulkheads and Decks

- □ All combustible structure or coverings removed from work area
- □ Combustible materials moved away from the opposite side of the work area

Work on Tanks and Enclosed Areas

- □ All combustible removed
- □ Containers purged of flammable liquids
- □ Marine Chemist Certified Safe for Welding

Fire Watch

- □ Required during and 30 minutes after work completed
- □ Provided with spare fire extinguisher
- □ Trained is use of equipment and fire reporting

7.8 Life Safety Considerations

7.8.1 Means of egress

The regulations pertaining to the arrangement of exits and stairways aboard Oceanographic and Research vessels are contained in the U.S. Coast Guard rules listed in 46 CFR 190.10, and were used to develop EPA policy for this section.

Briefly summarized, the criteria specify that two independent means of escape must be provided from all general areas where personnel are normally quartered or employed. The key word here is the use of the term "general areas". This does not mean that two means of escape are required from all areas. For example:

- Each stateroom normally has only one exit door. The exit door, however, leads to a passageway in the accommodations area, that in turn leads to two independent means of escape from the "general" accommodations area.
- Public areas larger than 300 square feet must have two independent means of escape. Aboard most EPA Class C vessels, this requirement would be applicable only to large public assembly areas such as dining areas or crew's lounges.
- Single laboratory areas larger than 300 square feet require two independent means of escape. Two means of escape must be provided from any laboratory area when one of the following conditions apply:
  - The laboratory contains an explosion hazard
  - A fume hood is located adjacent to the main exit
  - Compressed gas cylinders are present that are larger than a lecture bottle and contain a flammable gas or have a health hazard rating of 3 or 4 (NFPA 704)
  - Cryogenic containers are present that contain a flammable gas or have a health hazard rating of 3 or 4 (NFPA 704), or contain a substance that could prevent safe egress if an accidental release occurred

If the scientific mission requires that any of the above conditions exist, even on a temporary basis, the experiments must only be conducted in a laboratory with two independent means of escape.

The concept is to provide two independent, widely separated means of escape so that a single fire is not capable of preventing emergency evacuation. Aboard vessels, the means of egress are designed to provide a protected path up to the lifeboat and/or life raft embarkation areas. This is significantly different than in buildings, where the means of egress are arranged to provide a protected path down and out of the building on the ground floor. At sea, this does not present a significant concern, however, whenever a vessel is in port the evacuation is generally performed by having the personnel leave via the gangways to the dock. It may be necessary to develop special evacuation procedures if there are normally a significant number of personnel aboard the vessel while in port.

If public tours are permitted while the vessel is in port, a second set of evacuation procedures must be developed to ensure that adequate exit provisions are provided.

7.8.2 Personnel Accountability

It is important that all personnel aboard EPA vessels are accounted for at all times. A sign-in board or similar means should be used for this purpose. The Master must be aware of the number of crew, scientists, and guests aboard the vessel at all times while at sea. In port, an accountability process must be developed and enforced anytime a large number of visitors are present. In an emergency situation where evacuation of the vessel is required, it is vital that the Master or fire control team have this information readily available. Fire evacuation procedures should also assign personnel to search the vessel at the end of an evacuation to determine that all are accounted for.

7.8.3 Emergency Lighting and Exit Signs

Each vessel is required to have sufficient emergency lighting facilities and exit signs to allow safe egress from the vessel. The lighting fixtures are normally arranged to illuminate and mark the exit paths to the lifeboat and life raft embarkation stations. If the vessel is used for public tours while at the dock, the normal system of emergency lighting and exit path markings may be inadequate. Additional fixtures must be installed whenever a vessel is used for this purpose. These fixtures should provide an indication of the egress paths to the dock via the gangway. The crew should be trained on the two different evacuation routes.

7.8.4 Impediments to Egress

All exit paths and doors must be kept free from obstructions, however slight, at all times. Equipment may not be stored in exit passageways or adjacent to exit doors for any amount of time. Trash and debris must not be allowed to accumulate in any exit path. Locks or fastening devices must never be installed on doors (except watertight doors) that are required as an exit, unless the door can be opened from the egress side with a single hand action. Extra latches or hasps that require two actions to open the door must not be used. Exits must be maintained visible and readily discernible at all times. Any doorway or passageway that is not an exit path and could be confused with an exit must be marked "NOT AN EXIT" to prevent personnel from inadvertently traveling in the wrong direction.

7.9 Structural Fire Protection

Aboard vessels, the term "structural fire protection" is used to describe the barriers and insulating materials used to subdivide the vessel into protected fire areas. The fire area concept is used to protect less hazard areas from higher hazard areas and to also limit the extent of fire damage if a fire should occur. Structural fire protection aboard EPA vessels is engineered and installed on the vessel during construction or conversion. Existing EPA vessels are not required to comply with the USCG regulations unless modifications are made to the vessel's structure.

Structural fire protection principles are discussed here to allow an understanding of the barrier systems that are typically installed. In order for the structural fire protection to function as designed, it must remain intact. If openings are cut through required fire barriers for the passage of wiring or piping, the effectiveness of the system will be circumvented.

Bulkheads are defined in two categories, Class A and Class B. Class A bulkheads are steel barriers capable of preventing the passage of fire (burn through) for a period of one hour. Class B bulkheads are barriers capable of preventing the passage of fire for a period of thirty minutes. Class B bulkhead may be either steel or joiner work (Marinite). For certain areas, a temperature rise restriction is also placed on the bulkhead so that combustible materials on the unexposed side of the barrier are not ignited by heat transmission. For these barriers, a numerical rating is also applied to the bulkhead designation. For example, an A-30 bulkhead will not fail under fire conditions for 60 minutes, and in addition will prevent the temperature rise on the unexposed side of the barrier from igniting combustible material by heat transfer for a period of 30 minutes.

Aboard Research vessels the following minimum fire separations are required by the U.S. Coast Guard Regulations (46 CFR 190.07):

A Class boundaries: Boundary bulkheads and decks of general laboratory areas, chemical storerooms, galleys, paint lockers, and emergency generator rooms. Boundary bulkheads and decks that separate accommodations areas and control stations from hold and machinery spaces, galleys, main pantries, laboratories, and storerooms. Boundary bulkheads of elevator, dumbwaiter, and stair tower***** shafts.

A-15 Class boundaries: Boundary bulkheads and decks that separate laboratory areas of 500 square feet or less from accommodations areas and control stations.******

A-30 Class boundaries: Boundary bulkheads and decks that separate laboratory areas of over 500 square feet from accommodations areas and control stations.

B Class boundaries: Divisional bulkheads between laboratories, corridor bulkheads in accommodations areas.

***** A "stair tower" is a ladder or stairway that connects more than two decks. Stair towers are required to have approved A Class fire doors installed at each level. A "stairway" connects only two decks. A stairway is required to have an A Class or B Class fire door installed on only one of the two levels.

****** Control stations are generally the navigating bridge, the emergency generator room, and the radio room.

Before any modifications to the structure of EPA vessels are made and before any cables or piping

are temporarily or otherwise routed through existing bulkheads and decks, the vessel fire control plan must be reviewed to determine which boundaries are structural fire protection boundaries. These barriers must not be penetrated without proper protection of the fire barrier.

7.10 Fire Extinguishing Systems

Where Required:

Three types of fire extinguishing systems and equipment are required on EPA vessels:

- A fire main system;
- A fixed fire extinguishing systems for special hazards; and
- Portable fire extinguishers. (Portable extinguishers are not considered a fire extinguishing system, however, their criteria are felt best included in this section). Requirements for all three are found in the USCG regulations in 46 CFR 193.05.

7.10.1 Fire Mains

All EPA vessels are required to have a fire main consisting of one or more fire pumps, branch piping, and fire hose outlets located throughout the vessel. The arrangement of the system and required equipment is listed in 46 CFR 193.10.

7.10.2 Fixed Fire Extinguishing Systems

Fixed fire extinguishing systems are required for the protection of special hazards. Typically, total flooding carbon dioxide systems are used in this application.

On EPA vessels under 1000 gross tons, special hazards include chemical storerooms, paint lockers, oil rooms and similar spaces, as well as spaces containing gasoline powered engines.

For EPA vessels over 1000 gross tons, a carbon dioxide system is also required in engine rooms and auxiliaries with an aggregate power of 1000 bhp or greater. The arrangement of the system and required equipment is listed in 46 CFR 193.15.

7.10.3 Portable Fire Extinguishers

Portable fire extinguishers are required to be installed throughout all EPA vessels. The detailed requirements for portable fire extinguishers are listed in 46 CFR 193.50. All Fire extinguishers must be U.S. Coast Guard approved and UL labeled for marine use. The extinguishers must also be mounted in approved marine mounting brackets.

Fire extinguishers have two rating systems that are both included on the UL label:

- The NFPA 10 system uses a series of alpha numeric ratings (e.g. 4A 60BC); and

- The USCG uses a Roman Numeral type system (e.g. A-II). Under the USCG system, the letter indicates the type of fire that the extinguisher is suitable for, and the number indicates the relative size of the unit. The types of fire are identical to the NFPA 10 designations, where **A** rated extinguishers are for fires in ordinary combustible materials, **B** rated extinguishers are for fires in flammable liquids, and **C** rated extinguishers are for fires in electrical equipment.

  The USCG number designations for fire extinguisher sizes start with I for the smallest to V for the largest.

- Sizes I and II are considered portable fire extinguishers; and

- Sizes III, IV, and V are considered semi-portable fire extinguishing systems that are generally too heavy to be carried. These units are either installed in a fixed location and fitted with an adequate length of hose so that all portions of the space concerned may be covered, or mounted on wheels. Descriptions of typical types of extinguishers are provided in the following table:

USCG Classification

Type	Size	Water,Foam, Gals	CO_2, Gals	Dry Chemical, lb.	lb.
A	II	2 1/2	2 1/2	---	---
B	I	---	1 1/4	4	2
B	II	---	2 1/2	15	10
B	III	---	12	35	20
B	IV	---	20	50	30
B	V	---	40	100	50
C	I	---	---	4	2
C	II	---	---	15	10

The minimum fire extinguisher requirements applicable to typical spaces aboard **Class C EPA vessels** are listed here for ready reference:

Space	**Classification**	**Quantity and location**
Wheel House		None required.
Stairways		None required.
Elevators		None required.
Lifeboat embarkation stations		None required.
Staterooms, toilets		None required.
Public spaces, offices,		None required.
Lockers, pantries,		None required.
Isolated storerooms, etc.		None required.
Communicating Corridors	A-II	1 in each main corridor, not more than 150 feet apart.
Radio Room	C-I	2 in vicinity of exit.
Galleys involved	B-II or C-II	1 for each 2,500 ft^2 or fraction thereof, suitable for hazards
Paint Rooms	B-II	1 outside space, near exit.
Ships engine room 1000 bhp	B-II	2 minimum, plus 1 for every
Auxiliary Spaces, Internal Combustion	B-II	1 outside the space near exit.
Laboratories and Chemical storerooms each 300 of each exits.	C-II	1 Dry Chemical and 1 Carbon Dioxide for square feet, with one located near

The above listed criteria are the minimum requirements. All vessels are encouraged to consider the installation of extra fire extinguishers in any areas where they may be of added benefit.

Each EPA vessel must carry sufficient spare charges to recharge 50% of each type fire

extinguisher carried onboard. In lieu of carrying spare charges, spare extinguishers may be provided.

7.11 Precautions for Carbon Dioxide (CO2) Systems

The use of total flooding carbon dioxide systems aboard EPA Vessels can pose a hazard to improperly prepared personnel. Adequate training and understanding of the systems will allow their safe use. The mechanism by which carbon dioxide extinguishers fires is by displacing the oxygen available for combustion. For the extinguishing gas to work effectively, the protected space must be sealed off from the available air supply. Spaces protected by a total flooding system must be evacuated and sealed prior to the release of agent. Approved extinguishing systems have numerous built-in safeguards designed to prevent the accidental release of agent. Automatic release by smoke detectors is not permitted in occupied areas. Electrically operated releasing controls are also not permitted. Two separate and distinct actions are required to release the agent. One system release opens the cylinder control valves, while the second release opens the manifold stop valve. Unless both releases are operated, the carbon dioxide will not be released. Another built-in safeguard is the discharge time delay device. This is a pneumatic reservoir that prevents the release of agent for at least 20 seconds while the CO_2 siren sounds and the ventilation fans are stopped.

All personnel in a protected space must immediately leave if the CO_2 siren sounds and close the space boundary doors behind them. If a release of agent has occurred, the protected space must be thoroughly ventilated before re-entry is permitted. Carbon dioxide is heavier than air and will seek low lying areas. It is possible that agent released in one space will flow to lower areas such as the bilges. Caution must be used when entering these areas after a discharge of agent.

7.12 Fire Detection and Alarm Systems

7.12.1 Policy

While the U. S. Coast Guard requirements for Oceanographic and Research vessels do not specify the installation of a manual fire alarm or an automatic fire detection system, **it is EPA policy that all Class C vessels will have an installed fire alarm system.**

7.12.2 System Requirements

The system must consist of a U. S. Coast Guard approved fire alarm system, installed in accordance with the Manufacturer's recommendations.

All wiring and devices must be installed in accordance with the USCG Electrical Engineering Rules (Subchapter J, 46 CFR 110-113).

The control panel must be located on the navigating bridge or other continuously occupied location.

Battery back-up power supplies must be provided for each control panel.

The fire alarm signals must consist of both audible and visual devices. Manual pull stations must be located by main exits from occupied areas.

High hazard areas must be protected by smoke or heat detectors, as appropriate. High hazard areas include

- Machinery spaces
- Galleys
- Large storerooms
- Laboratories
- Chemical storerooms

All sleeping areas must be provided with smoke detectors.

The system must be subdivided into zones such that each deck is a separate zone. Small, isolated areas on adjacent decks may be included in a zone if the spaces communicate freely.

SECTION 8 - GENERAL MARINE ENGINEERING REQUIREMENTS

8.0 Background

EPA Vessels, as delivered, conform to all requirements and regulations of the Regulatory Bodies and Rules noted below in force at the time of delivery:

- American Bureau of Shipping Rules for Building and Classing Steel Vessels
- United States Coast Guard;
- United States Public Health Service, including all requirements to entitle ships to receive rat free and sanitary construction certificates;
- American Institute Electrical Engineers Standards;
- Federal Communications Commission; and
- American Bureau of Shipping Requirements for the Certification of the Construction and survey of Cargo Gear on Merchant Vessels.

Although EPA vessels are exempt, except for load lines, from the above Regulatory Bodies and Rules, the intent of the above Regulatory Bodies and Rules is adhered to in policy and, where practical, is reflected in this manual.

8.1 Standards

8.1.1 Construction and Testing

Where, in this manual, an item or method of construction or testing is required to meet the standards established by the American Bureau of Shipping, the standards in effect at the time of alteration to the vessel, or otherwise as applicable, shall be used. Standards that result in a lesser degree of safety for the vessel must be avoided. Shipbuilder's and manufacturer's operating procedures should be available for reference.

8.2.2 Preventive Maintenance (PM)

Procedures for the maintenance of the vessel and equipment are required to ensure that EPA vessels are maintained in conformity with relevant rules and regulations and EPA specific requirements. To meet these requirements, vessel specific procedures must be prepared to ensure:

Inspections of the vessel, equipment and spares are held at defined regular intervals. Such inspections should cover machinery, equipment and the vessel structure.

Non-conformities are reported with its possible cause, if known.

Appropriate corrective action is taken by ship and shore personnel.

Records of the above are maintained and monitored.

8.3 Marine Engineering Details

8.3.1 General Criteria

All marine engineering details such as piping, valves, fittings, boilers, pressure vessels, etc., and their appurtenances installed on the vessel insofar as practicable, shall be designed, constructed, and installed in accordance with the provisions of 46 CFR parts 50 through 64, or other related standards for marine engineering as related to inspected vessels. Suitable hand covers, guards, or rails must be installed in the way of all exposed and dangerous places such as gears, machinery, etc.

8.3.2 Color Coding

Piping systems should be marked in accordance with the following Coast Guard-approved color legend:

Fresh Treated Engine Cooling Water	Light Blue
Saltwater	Dark Green
Fire Systems and Mains	Red
Diesel Fuel	Yellow
Lubricating Oil	Striped Yellow and Black
Hydraulic Systems	Orange
Ship Service Air	Tan
Starting and Control Air	Dark Gray
Steam	White (with pressure and direction)
Fresh Potable and Distilled Water	Dark Blue
Sewage	Gold
Refrigerants	Dark Purple
Oxygen	Light Green
Nitrogen	Light Gray
Halon	Striped Gray/White

8.4 Exhaust Uptake and Vent Control

Internal combustion engine exhausts, boiler and galley uptakes, and similar sources of ignition must be kept clear of, and suitably insulated from, any woodwork or other combustible matter. Uptakes, stacks, etc., must not be used for storage of combustible material.

Except as noted in these regulations, all enclosed spaces within the vessel must be properly vented or ventilated. Means shall be provided to close off all vents and ventilators. Weather deck vents, covers, and closure devices must be properly maintained. Dampers or other means of closure must be adequately marked in red to indicate the opened and closed positions.

Means must be provided for stopping all fans in ventilation systems that serve machinery and storage spaces and for closing all doorways, ventilators, and annular spaces around stacks and other openings to such spaces in case of fire.

8.5 Electrical Engineering Details

For all new vessels, and modifications to existing vessels, all electrical engineering details and installations must be designed and installed in accordance with 46 CFR, parts 110 through 113. Electrical wiring methods must conform to IEEE-45 and National Electrical Code USCG Adopted Standards.

Battery lockers and eyewash stations must have appropriate eye and skin burning hazard warning signs and "no smoking" signs posted.

8.6 Structural Standards and Alterations

8.6.1 General

Compliance with the standards established by the American Bureau of Shipping will be considered as satisfactory evidence of the structural efficiency of the vessel. Current ABS classed vessels must meet these standards and inspection requirements.

8.6.2 Alteration**s**

Approved alterations to all other EPA vessels should strive to meet American Bureau of Shipping Standards. Spaces must remain in use as originally designed unless specifically approved for alteration, and if ship structural alterations are involved, the changes must be approved Headquarters EPA.

8.6.3 Habitability

Habitability improvements or rearrangements that do not change the functions of a space or involve bulkhead alterations can be approved by the EPA program management. Use of flammable material such as wood paneling, studding, firing strips, and flammable drapes are prohibited. Ceilings, linings, and insulation, including pipe and duct lagging, shall be of approved non-combustible materials.

8.7 Stability

8.7.1 Responsibilities

It shall be the responsibility of the vessel's Master to maintain the ship in a condition of satisfactory stability throughout the duration of the voyage.

8.7.2 Stability Documentation

The vessel's Master and Chief Engineer must be supplied with a Trim and Stability Booklet that provides rapid and accurate information concerning the stability of the ship under varying conditions of load. The content of this document must be in accordance with applicable U.S. Coast Guard requirements, as described in 46 CFR 170.

At a minimum, the Trim and Stability Booklet provides the operators with instructions and information sufficient to permit computation of the vessel's metacentric height (GM) and to determine whether the value so determined is adequate. It generally includes several "standard" loading conditions with adequate stability; these calculations must be modified by the operator if the actual loadings are expected to differ significantly and the resulting GM checked against criterion provided.

Revisions of a vessel's Trim and Stability Booklet shall be published as required. These revisions are generally prompted by significant changes in a vessel's configuration. EPA Vessel Management Officials must maintain records of known weight and center changes resulting from vessel modifications.

8.7.3 Damage Stability

In addition to damage stability information contained in the Trim and Stability Booklet, most vessels have been provided with flooding effect diagrams to provide dewatering and counter flooding guidance following hull damage. The vessel's Master should be familiar with the use of these materials.

8.7.4 Maintenance of Watertight Integrity

Watertight bulkheads shall be maintained watertight. Any modifications or repairs to watertight structures must restore the original watertight integrity of the structure. If a main transverse watertight bulkhead is penetrated, the penetration must be made watertight. Lead or other heat sensitive materials must not be used in a system that penetrates a main transverse watertight bulkhead if fire damage to this system would reduce the watertight integrity of the bulkhead. If a pipe, scupper, or electric cable passes through a main transverse watertight bulkhead, the opening through which it passes must be watertight.

Decks occasionally act as bulkheads, this occurs when main transverse bulkheads above and below a deck are offset (by design) and the deck forms a "connector" between them. This portion of the deck must be maintained watertight if the bulkheads are to be effective.

Watertight and weather tight doors and hatches and their associated fittings must be kept in good repair to ensure their suitability as portions of the watertight envelope. Any modifications or repairs to these items shall be followed by hose testing, if feasible, otherwise by chalk testing.

"Keep Closed" markings shall be provided at all weather envelope access closures and at any manually operated doors in main transverse bulkheads, in order to ensure their closure at sea.

8.7.5 Stability Letter

Each Class C vessel must have a stability letter issued by the USCG. This letter sets forth the Conditions of operation. This requirement also applies to Class B vessels that have been modified in such a way that stability could have been affected.

> **Note:** A stability letter is not required if the information can be, and has been, placed on the Load-Line Certificate. (46 CFR 170.120)

8.8 Ground Tackle

8.8.1 The Preservation Cycle

The preservation cycle for the anchor chain shall be at least once every three years for vessels operating in salt water and once every five years for vessels operating in fresh water. The chains shall be cleaned, scaled, and carefully inspected for defects. The shackles and detachable links and their pins may be refitted, identification marks restored, and shots shifted to new positions, as necessary in order to distribute uniform wear throughout the entire length of the chain. Chains should be repainted whenever necessary to prevent

excessive corrosion.

8.8.2 Anchor Chain Markings

These markings shall be painted as follows to identify the length of chain (measured in "shots" or 15 fathom or 90' increments) paid out:

- One link on each side of the 15 fathom detachable link shall be painted white;
- Three links on each side of the 45 fathom detachable link shall be painted white, etc;
- All detachable links shall be painted red;
- The exception to the foregoing is that all of the links in the last 15 fathoms shall be painted red, and all of the links in the next adjoining 15 fathoms shall be painted yellow;
- Anchor chain shall be marked by turns of wire on the studs of certain links. The number of links counting away from the detachable link is used as a marker for that shot;
- The first link at each side of the 15 fathom detachable link has one turn of wire around the stud;
- The second link at each side of the 30 fathom detachable link has two turns of wire around the stud;
- The third link at each side of the 45 fathom detachable link has three turns of wire around the stud, etc.

8.8.3 Inspection

Chains must be periodically inspected to determine wear. If any part of the chain has been reduced by corrosion or wear so that the mean diameter is reduced to 90 percent of its original diameter, or the length of six links exceeds the original length of these links plus the wire diameter of the chain in inches due to wear or elongation, or a combination of both, that part must be replaced.

8.9 Oxygen and Acetylene Cylinders

8.9.1 Receiving Cylinders Aboard

Upon pier-head delivery of oxygen and acetylene cylinders and before accepting and receipting, a close and careful inspection of the cylinder must be conducted by a qualified member of the crew, as designated by the Master. Any oxygen or acetylene cylinder that has evidence of heavy deterioration or wastage, is not stamped with a recent hydrostatic test date, or doesn't have a protective cap in place shall not be accepted for use on board the vessel (Note: Acetylene cylinders do not require a hydrostatic test).

8.9.2 Stowage Onboard

Keeping in mind the size and arrangement of the vessel, the following precautionary measures must be taken to ensure proper and safe stowage of oxygen and acetylene cylinders onboard EPA vessels, per 46 CFR 147:

8.9.2.1 Cylinders shall be stowed upright and secured in a permanent rack to prevent shifting and toppling.

8.9.2.2 Valve protection caps shall be secured in place at all times while cylinders are in storage.

8.9.2.3 Readily combustible materials (such as wood, rags, and paper, especially if soaked in grease or oil) shall not be present in close proximity of the cylinder storage areas.

8.9.2.4 Cylinders should be stowed in a well-ventilated space so that any leakage will be carried away.

8.9.2.5 Spark-producing tools and electrical appliances should not be operated in cylinder storage areas.

8.9.2.6 "Warning" and "No Smoking" signs shall be clearly and prominently displayed in cylinder storage spaces.

8.9.2.7 Oxygen cylinders should be stowed as remotely as possible from acetylene cylinders.

8.9.2.8 Cylinders shall be protected from temperatures exceeding 100/F.

8.9.3 Backflow Valves

Backflow or flashback valves shall be installed in all lines of gas welding and cutting equipment. The valves may be installed at either the torch or regulator ends of the lines with installation at the regulator end preferred.

8.9.4 Propane

The use and/or storage of propane aboard EPA vessels is prohibited, except as follows:

8.9.4.1 The limited use of small, hand-held propane torches while in port, and the stowage, in port, of such small propane tanks in well-vented flammable-material lockers located appropriately on the weather decks.

8.9.4.2 Transportation aboard EPA ships in the form of deck cargo in response to clearly identified project needs such as propane-fueled thermal generators for the use of radio navigational aids, etc.

With respect to these exceptions, quantities shall be limited to identified needs, and containers (both full and empty) should be removed from the vessel as soon as possible. All compressed combustible gas containers must be securely stored in well-vented weather deck containers or racks which are easily jettisonable, insofar as is practicable.

8.10 Scientific Equipment

8.10.1 Background

Scientific equipment carried on board research vessels ranges from the completely standardized, which everyone is familiar with (such as CTD/Rosettes and rock dredges), to one-of-a-kind developmental hardware which may be strange to all hands, including the scientists. From this, two safety concerns arise:

8.10.1.1 Familiarity may lead to carelessness with gear which is still inherently dangerous in itself. At the other extreme, novel equipment whose potential hazards are not known can lead to unpleasant surprises. In either case, both crew and scientific party should exercise the greatest prudence and caution, particularly if the scientific operation might be dangerous to the ship and to personnel other than the immediate users.

8.10.1.2 With a very few exceptions, scientific equipment is not covered by federal laws and regulations. It is all the more important, then, that all hands approach research operations with particular care, using the principles of good seamanship, sound marine engineering practices, and common sense.

In the case of inspected vessels, 46 CFR contains rules for certain examination and testing procedures. All EPA vessels using such gear should strive to meet these safety standards as applicable. But in the majority of cases CFR and other rules delegate the responsibility for safety procedures to the operator, thus placing a heavy burden on those involved. **Accordingly, the Chief Scientist must ensure through the site safety plan that the Master of the vessel has been provided with all necessary information for**

he or she to evaluate the potential risks to the vessel and crew.

8.10.2 Operating Instructions

It is not possible to cover all the myriad of cases of safety problems involved with research operations. Accordingly, each EPA vessel of all classes will have on board, an overboarding equipment operations and maintenance manual specifically developed for that vessel and kept current. A visual inspection check-off sheet and instructions for use will be developed for all weight handling equipment.

8.10.3 Weight Handling Equipment

Many heavy or bulky items of research equipment are handled over the side, usually on wire rope. The following applies to all EPA Vessels with such equipment installed:

8.10.3.1 All the handling gear involved should be installed to meet recognized codes and specifications.

8.10.3.2 The entire installation should be in accordance with the approved stability data.

8.10.3.3 Where applicable, stress and general design calculations should be performed.

8.10.3.4 Operating limitations should be clearly posted, and operators of winches, cranes, and the like qualified in their use.

8.10.3.5 At a minimum, a visual inspection of the entire winch, A-frame and wire rope, in operation, shall be accomplished annually by a competent person who will certify safe operations and safe operating limits and so post a certification on the equipment. A load test to 125% of the load handling equipment rated capacity will be accomplished by a competent person at a minimum of every two years.

8.10.3.6 Wire rope will be sized to a safety factor of five of the working load, based upon the rated pull of the winch. In other words, if the winch rated pull is 1,000 pounds, then the wire rope used on that winch will have a breaking strength of no less than 5,000 pounds.

8.10.3.7 Since over stresses may degrade the long term safety factor, records should be maintained of tests, excessive loading, maintenance,

alterations, and other factors.

It should be noted that these strength precautions become even more important as the value of the equipment being lowered increases, in addition to potential delays of the scientific program and hazards to operating personnel. (46 CFR 189.35)

8.11 Watertight Integrity

8.11.1 Background

The watertight integrity of a vessel is absolutely essential to the viability of calculations on which freeboard assignment is based as it is for stability and subdivision considerations. In general, it involves providing, maintaining and correctly operating sure and efficient means of protecting all openings in the hull, watertight bulkheads and superstructure considered watertight. These openings including hatches, side openings and the like. The myriad of requirements concerning the design, construction, location and operation are grouped together in "Conditions of Assignment." These conditions are reviewed annually and periodically, every five years, during load line inspection and surveys on applicable vessels.

8.11.2 Applicability

8.11.2.1 For EPA Class B vessels over 65 feet in length and Class C vessels, watertight integrity guidelines are given in the stability section of the USCO NVIC No. 5-86.

8.11.2.2 For vessels under 65' long, guidelines are provided in "Safety Standards for Small Craft" by ABYC (ABYC H-3-70, H-4-70, and H-27-72).

8.11.3 Responsibilities

8.11.3.1 Masters of EPA vessels have the responsibility for maintaining the watertight integrity of these vessels. This responsibility involves the careful maintenance of all watertight closures and associated systems and the assurance that their functions, operation and status in various normal and emergency conditions are clearly understood by members of the crew and science party.

8.11.3.2 Further, Masters of EPA vessels subject to load line requirements have the responsibility to maintain load line certificates and current survey reports on board their vessels and to comply with all terms and conditions

stated in these documents. These Masters should keep logbook records as prescribed in 46 CFR, Subchapter E, Section 42.07-20.

8.11.4 Information

Sources of information on the details of watertight integrity include:

- CFR 46, Subchapter E, Subpart 42.15, entitled "Conditions of Assignment of Freeboard," contains details on doors, hatches, machinery space openings, miscellaneous openings, ventilators, air pipes, cargo ports, scuppers, inlets and discharges, side scuttles, and freeing ports.
- CFR 46, Subchapter 0, Subpart 69.03 (69.03-67) contains information on tonnage openings.
- CFR 46, Subchapter H, Subpart 72.05 contains information on windows and air ports.
- CFR 46, Subchapter H, Subparts 78.15 and 78.17 contain information on doors to be closed at sea and closing appliances
- CFR 46, Subchapter I, Subpart 97.15 contains information on hatches and other openings.
- CFR 46, Subchapter S, Subparts 170.248 and 170.070 contain information on watertight bulkhead doors and oceanographic research vessel subdivision.
- NVIC 5-86 ("Voluntary Standards for U.S. Uninspected Fishing Vessel S") contains information on watertight integrity on pages 5-6 through 5-8.

SECTION 9 - LIFESAVING AND SAFETY EQUIPMENT

9.1 General Provisions

9.1.1 Approved Equipment

Lifesaving equipment aboard (Personal Flotation Devices (PFD), rafts, signaling equipment, etc.) EPA Vessels shall be equipment that has been approved by the U.S. Coast Guard (USCG). Where items of lifesaving equipment are not required but are installed, such equipment and its installations shall also meet the requirements of the USCG.

Applicability - All EPA Vessels

9.1.2 Replacement Equipment

All replacement lifesaving equipment shall meet the 1983 Safety of Life at Sea (SOLAS) Amendments.

Applicability - All EPA Vessels

9.1.3 Instruction In Use of Lifesaving Equipment and Survival at Sea

The following requirements are established for providing instructions in the use of onboard lifesaving equipment and survival at sea:

9.1.3.1 Class C Vessels

9.1.3.1.1 For new crew members, new members of the scientist team, and visitors for at-sea operations, training must be provided prior to the vessel getting underway or shortly thereafter.

9.1.3.1.2 Class C vessel Masters shall conduct such drills and give such instructions as are necessary to ensure that all hands are familiar with their duties as specified in the station bill.

9.1.3.1.3 Class C vessels will conduct a fire drill and boat drill weekly while underway on extended missions beginning within 24 hours of leaving port. Drills should simulate actual emergencies and all fire and emergency equipment should be exercised on a regular basis.

9.1.3.1.4 At least once per year, an in-port fire drill should be conducted with shore side fire units participating.

9.1.3.1.5 While underway, a man overboard drill shall be conducted at least once monthly on extended cruises, or at random during sporadic cruise periods.

9.1.3.1.6 Back up Rescue boats should be launched with their assigned crew aboard and maneuvered in the water at times determined by the Master, to ensure boat readiness and crew training.

9.1.3.1.7 In addition, training concerning all the vessel's lifesaving equipment must be covered within every two month period for the crew and scientist team.

If necessary, every other weekly drill may be converted to a training session to meet this requirement. Use of lifesaving equipment during weekly in-port and at-sea training drills is encouraged. If a training session is substituted for a drill, the weekly inspection of inflatable life rafts, rescue boats, and launching appliances, operation of the rescue boat motors, and test of the emergency alarm, as applicable, is still required.

9.1.3.1.8 A record of all drills and tests of alarms, etc., should be documented and kept in a file separate from the vessels log book. The documentation must include a description of the exercise and the names of all participants.

9.1.4 Class B Vessels

9.1.4.1 Masters of Class B vessels, because of the limited number of personnel on board and relatively short and intermittent mission schedules, will assemble all people aboard prior to leaving port and inform and review emergency situations that may arise, the signals and the action that will take place. Demonstrations of survival suits, if appropriate, use of work vests and other life saving issues should be reviewed.

9.1.4..2 Masters shall have a detailed written policy regarding compliance with this paragraph.

9.1.5 Class A Vessels

Operators of Class A vessels will ensure that their passengers/crew are familiar with life saving, fire and emergency equipment, and procedures prior to getting underway.

9.2 Instructions and Repairs

9.2.1 Lifesaving Training Manual

A lifesaving systems and equipment training manual, assembled from manufacturers' information and other survival training information, is required. Loose leaf format in a ring binder is suggested so that additional or revised information can be added as it is received. Audiovisual training material is encouraged. A copy of the manual should be kept in each mess area or lounge, so that it is available for review by the crew and scientist team. The following should be explained in detail:

9.2.1.1 Donning of PFDs and immersion suits, as appropriate;
9.2.1.2. Muster at the assigned stations;
9.2.1.3 Boarding, launching, and clearing the survival craft and/or rescue boats;
9.2.1.4 Method of launching the survival craft and release from launching appliances;
9.2.1.5 Methods and use of devices for protection in launching areas, where appropriate;
9.2.1.6 Illumination in launching areas;
9.2.1.7 Use of all survival equipment;
9.2.1.8 Use of all detection equipment;
9.2.1.9 Use of radio lifesaving appliances;
9.2.1.10 Use of drogues;
9.2.1.11 Use of engine and accessories;
9.2.1.12 Hazards of exposure and the need for warm clothing;
9.2.1.13 Best use of survival-craft facilities in order to survive;
9.2.1.14 Methods of retrieval, including the use of helicopter rescue gear (slings, baskets, stretchers), breeches buoy, shore lifesaving apparatus and ship's line-throwing apparatus;
9.2.1.15 All other functions contained in the muster list, including emergency instructions; and
9.2.1.16 Instructions for emergency repair of lifesaving appliances.

Applicability - EPA Class B and C Vessels

9.2.2. Instructions for Onboard Maintenance

Instructions for onboard maintenance of lifesaving equipment should be easily understood, illustrated wherever possible, and as appropriate, shall include the following for each piece of equipment:

9.2.2.1 A checklist for use when carrying out the periodic inspections required;
9.2.2.2 Maintenance and repair instructions;
9.2.2.3 Schedule of periodic maintenance;
9.2.2.4 Diagram(s) of lubrication points with the recommended lubricants;
9.2.2.5 List of replaceable parts;
9.2.2.6. List of sources of spare parts; and
9.2.2..7 Log for records of inspections and maintenance.

Applicability - EPA Class B and C Vessels

9.2.3 Spares and Repairs
Maintenance shall be in accordance with manufacturer's specifications. Spares and repair equipment are required on board. If the various maintenance manuals do not specify lists of spare parts recommended to be on board, the vessel must have the parts most frequently used in onboard maintenance. Permanent repairs to the inflated components of inflated life rafts must be carried out at approved servicing stations.

Applicability - EPA Class B and C Vessels

9.3 <u>Life Rafts</u>: All inflatable life rafts shall be of an approved type. Each inflatable life raft shall have a carrying capacity of not less than 6 or more than 25 persons. All stowage and embarkation areas shall have adequate emergency lighting. All Class B and C Vessels, that operate in the ocean or on the Great Lakes, shall be provided with sufficient inflatable life rafts so that the total capacity available will accommodate 100 percent of the total number of persons on board.

9.3.1. Life rafts shall be readily available in the case of any emergency, and shall be kept in good working order and available for immediate use at all times when the vessel is being navigated, and insofar as reasonable and practicable, while the vessel is not being navigated. The decks on which life rafts are stored shall be clear of any obstructions that would interfere with the immediate launching of the lifesaving appliances. Each inflatable life raft must be stowed so that it:

9.3.1.1. Is capable of being launched within 10 minutes;
9.3.1.2. Does not impede the launching or handling of other lifesaving appliances;
9.3.1.3. Does not impede the marshaling of persons at the embarkation stations;
9.3.1.4 Is capable of being put in the water safely and rapidly even under

unfavorable conditions of list and trim; and

9.3.1.5 Will float free in the event of the vessel sinking.

9.3.2 Every EPA vessel equipped with inflatable life rafts shall have posted in conspicuous places, readily accessible to the crew, scientist team, and passengers, placards containing instructions for launching and inflating life rafts. The number of such placards shall not be less than one and shall be sufficient in quality in the opinion of the Master to serve the instructional purpose intended. Placards are available from the life raft manufacturers. Placards are also required at each life raft station.

9.3.3. There shall be stenciled in a conspicuous place in the immediate vicinity of each inflatable life raft, in 2-inch-high letters with the following marking:

INFLATABLE LIFE RAFT NO.

PERSONS CAPACITY

Note: This marking shall NOT be on the life raft container.

9.3.4 Life rafts must be fully equipped before the vessel is navigated and the equipment shall remain in such lifesaving appliances throughout the period of the vessel's operation. Equipment shall be in accordance with 46 CFR 199. Loose equipment must be securely attached to the appropriate lifesaving appliance.

9.3.5 Where the freeboard at an embarkation point is such that embarkation devices are necessary, sufficient ladders or other suitable devices must be available to facilitate embarkation into inflatable life rafts when waterborne.

9.3.6 Provisions shall be made for readily and continuously available illumination on the vessel for life raft launching and embarkation areas. The power source for this lighting shall be either the emergency generator or emergency batteries. **Note:** EPA vessels that <u>never</u> operate before official sunrise or after official sunset may omit this provision.

9.3.7 Inflatable life rafts that have been held in storage ashore without inspection for over 6 months shall be re-inspected per USCG guidelines before re-installation aboard ship.

Applicability - EPA Class B and C Vessels

9.4 <u>Back Up Rescue Boats</u>

9.4.1 General Criteria

9.4.1.1 EPA Class C Vessels, and Class B Vessels >65', shall be equipped with at least one small boat that can be used for rescue purposes. The intended mission of this boat, as a rescue boat, is for backup rescue of persons accidentally falling over the side when the Master determines that the vessel can not maneuver sufficient to effect a man overboard recovery. This boat need not be Adedicated for rescue only@, and may be used for other purposes as determined by the EPA Vessel Management Official and the Master. A written ABack Up Rescue Boat@ policy, operating procedure including communications, maintenance and state of readiness, crew training and procedure during man overboard drills shall be prepared for each vessel. Included, will be identification of life saving equipment to be carried and or readily available as well as boat markings.

9.4.1.2 A designated back up rescue boat may be of rigid or rigid-hull, inherent-buoyancy (RHIB) construction with built-in buoyancy. At a minimum, the boat shall be large enough to be operated by two trained crew members, an operator and a linesman if power operated, or an oarsman, with sufficient capacity for a minimum of two rescued individuals. The selection of the boat, power and quick launching method should be consistent with the most accessible location on the vessel.

9.4.2 Operation

Boats designated as a back up rescue boat, must be maintained in a state of continuous readiness during all times the vessel is underway. A target launching time of within 5 minutes is recommended. A boarding ladder shall be available and accessible in case of emergency as well as a tending line (painter) securing the rescue boat beside the ship to safely embark personnel. During man overboard drills, the back up rescue boat will be made ready for launch upon the order of the Master. Actual over the side exercises shall be made at the discretion of the Master to ensure a state of crew and boat readiness. This shall be done in accordance with the policy established for each applicable vessel.

Applicability - EPA Class C Vessels and Class B Vessels > 65'

9.5 Personal Flotation Devices (PFD

9.5.1 General

All PFDs shall be of a USCG-approved:

- Type I for Ocean and Great Lakes operations; or
- Type I, II, or III for rivers, harbors, bays, and lakes other than the Great Lakes.

All EPA vessels shall be provided with a serviceable Type I, II, or III PFD for each person on

board. EPA Class A vessels greater than 16' in length shall also carry at least one Type IV PFD (Throwable). PFDs shall also be provided for personnel on watch in the engine room, pilothouse, bow lookout, plotting room, radio room, and any other space normally requiring the stationing of personnel away from their assigned PFDs. In any case, the total number of PFDs shall not be less than 100 percent of the ship's on board count, excluding PFDs for launches.

If an EPA vessel embarks children, as on tours or demonstration missions, provision shall be made to provide PFDs compatible with the size of the embarked children. (46 CFR 190.70)

9.5.2 Distribution and Storage

PFDs must be distributed throughout the quarters for vessel and scientific personnel and other places readily accessible for each person on board. The storage of an additional number of PFDs required by these regulations shall be such that they are readily accessible to personnel on watch. PFDs shall be stored away from heat, oil, and caustic substances.

PFDs stored overhead must be supported so that they can be quickly released and distributed. Where PFDs are stowed at a height greater than 7 feet above the deck, efficient means for quick release must be provided and must be capable of operation from the deck.

9.5.3 Marking

9.5.3.1. Each PFD must:

9.5.3.1.1 Be clearly stenciled with the vessel's name or, as applicable, the vessel number, or an EPA Regional designation. - **Note:** The purpose of this requirement is to help identify equipment from an EPA vessel that may be lost or overdue;

9.5.3.1.2 Have retroreflective markings if night-time operations are conducted - Retroreflective material shall have at least 200 square centimeters on its front and backsides. The retroreflective material must be equally divided between the upper quadrants and attached near the shoulder area of the life preserver.

9.5.3.2 Each PFD storage locker (If installed) shall be clearly and distinctly marked in 3-inch red letters stating the number of preservers contained therein, such as "25 ADULT PERSONAL FLOTATION DEVICES."

Applicability - All EPA Vessels

9.6 Work Vests

9.6.1 USCG-approved buoyant work vests are items of safety apparel, and may be carried

aboard EPA vessels, of any size, to be worn by persons when working near or over the water under favorable working conditions. EPA SHEMPs shall determine when work vests are required or recommended.

9.6.2 When work vests are carried:

9.6.2.1 They are not accepted in lieu of any of the required number of approved PFDs and must not be worn during drills and emergencies.

9.6.2.2 On Class B and C Vessels, the approved buoyant work vests must be stored separately from PFDs and in locations where they will not be confused with PFDs.

9.6.2.3 They must be equipped with retroreflective material in accordance with NVIC 1-87. One hundred square centimeter strips are required on each upper front section and a 200-square centimeter strip on the upper back portion of the vest.

9.6.2.4 They shall be periodically inspected. A work vest, the material condition of which no longer supports its intended purpose, shall be immediately disposed of.

Applicability - All EPA Vessels

9.7 Exposure Suits

9.7.1 General

All exposure suits must be USCG-approved. As some designs of exposure suits will not turn an unconscious wearer face up in the water; SOLAS' convention continues to require that traditional life preservers be carried in addition to exposure suits.

9.7.2 Number Required

EPA vessels, operating in waters above 32 degrees (Approximately Savannah, GA) North latitude in the Atlantic or above 35 degrees North latitude in all other waters, are required to carry one exposure suit for each bunk, sized to fit the person occupying the bunk. In addition, the engine room, pilothouse, bow lookout, if applicable, and each work station not readily accessible to cabins, staterooms, and berthing areas should have enough exposure suits to equal the number of people normally working there at one time. Each exposure suit required for a work station should be stowed in a readily accessible area in or near the station.

9.7.3 Marking

Each exposure suit shall be clearly stenciled with the vessel's name and the suit's number. Neither the suits nor the storage bags shall be marked with an individual's name.

Applicability - All EPA Class B and C Vessels in applicable waters.

9.8 Personal Flotation Device Lights and Whistles

9.8.1 Each PFD and exposure suit must have a personal marker light (PML) that is USCG approved and fully operable. The date of expiration of the battery shall not be exceeded. If no expiration date is available, then the battery should be replaced annually. Each PML light required must be securely attached to the front shoulder area of the life preserver or exposure suit. **Note:** EPA vessels that never operate before official sunrise or after official sunset may omit this provision.

9.8.2 Additionally, each PFD and each exposure suit must have a whistle of the ball type or multi-tone type, with corrosion-resistant construction that is in good working order. The whistle must be attached by a lanyard long enough to permit the whistle to reach the mouth of the wearer.

Applicability - All EPA Class B and C Vessels - Strongly recommended for Class A vessels

9.9 Ring Lifebuoys, Waterlights, and Smokepots

9.9.1 All ring buoys must be 30-inch, USCG-approved type. Refer to NVIC 1-87 for retroreflective material requirements (i.e., 4 sections, each 2 inches wide, on both sides of ring buoy).

9.9.2 The minimum number of approved 30-inch ring buoys and the minimum number that must have waterlights attached for EPA vessels shall be in accordance with the following table:

VESSEL LENGTH	TOTAL REQUIRED	TOTAL LIGHTED
Class B 65' or less	2	1
>65' - <100'	4	2
>100'	6	4

9.9.3 Ring life buoys must be distributed so that they are readily available on both sides of the vessel and, as far as practicable, on all open decks extending to the vessel's side. At least one shall be placed in the vicinity of the stern. All units shall be stowed so that they are capable of being rapidly cast loose and not permanently secured in any way.

9.9.4 One of the ring life buoys on each side of the vessel must be secured to a buoyant line

at least 15 fathoms in length. On EPA vessels 100 feet or greater in length, at least two of the USCG-approved lighted ring buoys shall also be provided with an approved self-activating smoke signal. The smoke signal service life is 3 years and 6 months from the date of manufacture.

9.9.5 Ring life buoys must be orange with black lettering marked with the name of the vessel and designator in 1-1/2 inch block letters. A grab line, secured at four points, must hang free from the life ring. Stenciling over the retroreflective material is not permitted.

Applicability - All EPA Class B and C Vessels

9.10 Line-Throwing Appliances

EPA Class C Vessels and Class B Vessels greater than 65' in length, shall carry a Navy MARK 87 Line-Throwing Appliance or equivalent. Each vessel will have 10 projectiles, 25 cartridges, and 4 shot lines per unit. The line-throwing appliance should be tested at least quarterly. EPA Class B Vessels 65 feet or less in length, shall carry a manually thrown line-throwing device.

Applicability - All EPA Class B and C Vessels

9.11 Deck Safety Equipment

9.11.1 Ship's Distress Signals/Pyrotechnic Locker

EPA vessels shall carry, in the vicinity of the vessel's navigation bridge or pilothouse, not less than 12 approved hand-held rocket-propelled parachute red flare distress signals. Such distress signals must be stored in a portable watertight container, labeled "DISTRESS FLARES." The service use of the distress signals is limited to a period of 42 months from manufacturer's date.

Applicability - All EPA Class B and C Vessels

9.11.2 Hard Hats

Approved head protection shall be provided to all persons involved in deck operations that require the use of hard hats. The Regional safety staff can advise on the type of head gear required, based on the involved tasks.

Applicability - All EPA Class B and C Vessels - For Class A Vessels as determined by the local safety officer.

9.11.3 Tethers (Lifelines)

Vessel Masters shall make available tethers for use as appropriate by persons in deck operations. These must be of easy-release belt or shoulder type with adequate buoyant line. Safety belts with lifeline shall be worn by all personnel when going aloft in rigging or on masts or when working topside in heavy weather.

Applicability - All EPA Class B and C Vessels, and Class A Vessels as determined by local authority.

9.11.4 Safety Goggles

Approved eye protection shall be worn during dirty deck work, any work involving acids or solvents, anchor windlass operation, machine tools, or any other work presenting an eye hazard. The Regional safety staff can advise on the type of eye protection required, based on the involved tasks.

Applicability - All EPA Class B and C Vessels, and Class A Vessels as determined by local authority.

9.11.5 Signal Lights

EPA Class C Vessels, if on an international voyage, must have a daylight signaling light that, as a minimum, is a hand-held portable light of at least 60,000 foot candles with a means for rapidly switching on and off, while being energized from a self-contained storage battery that can operate the light continuously for 2 hours without recharging.

Applicability - EPA Class C Vessels - As applicable

9.12 Emergency Breathing Apparatus

A minimum of two demand-type self-contained breathing apparatus (SCBA) is required to be aboard each EPA Class C Vessel, in accordance with Section VI of this manual. SCBAs shall be distributed throughout the vessel in such a manner that a single shipboard casualty will not prevent access to all of the units. Each unit shall be stowed with a complete set of instructions and a safety line consisting of a 50-foot length of 3/16-inch steel wire equipped at each end with a snap hook.

9.12.1 Self-Contained Breathing Apparatus (SCBA**)**

SCBAs currently authorized for shipboard use must be units previously approved by the USCG or be units certified by the National Institute for Occupational Safety and Health

(NIOSH) and the Mine Safety and Health Administration (MSHA). NIOSH/MSHA-certified equipment that meets the following requirements is approved for shipboard use.

9.12.1.1. Such equipment must:

9.12.1.1.1 Be capable of pressure demand or positive pressure operation;
9.12.1.1.2 Be open circuit equipment;
9.12.1.1.3 Have 30 minutes minimum duration; and
9.12.1.1.4 Be provided with a full face piece.

9.12.1.2 Steel SCBA air cylinders shall be hydrostatically tested at least every 5 years, and the date of the test shall be stamped on the cylinder. Fully wound composite air cylinders (aluminum liner fully wrapped with high strength glass filaments except for the thick neck area) and hoop-wound composite air cylinders (aluminum liner wrapped on sides only) shall be hydrostatically tested at least every 3 years, and the date of the test shall be affixed on the cylinder with a sticker. Because of the degradation of the composite material's strength over time, composite cylinders have a service life of 15 years from the date of manufacture.

9.12.1.3 Steel and composite SCBA air cylinders shall receive a visual internal and external inspection annually by an authorized servicing facility. Air cylinders that pass this inspection shall be affixed with a dated visual inspection sticker.

9.12.1.4 Vessels equipped with a diver's air compressor shall maintain the capability for recharging SCBA cylinders. Vessels without a recharging capability are required to carry spare SCBA cylinders.

9.12.1.5 Persons designated to use SCBA must be trained and receive medical approval for such use.

Applicability - EPA Class C Vessels - Other class vessels as determined by the Vessel Management Official.

9.12.2 Emergency Escape Breathing Apparatus (EEBA)

EEBAs are low duration (less than 15-minutes), self-contained breathing devices intended as "one-time use only" escape systems. They are not intended for use as firefighting or rescue breathing apparatus and shall not be used to supplement or replace breathing equipment required for those purposes. EEBAs may be located in berthing spaces, engineering spaces, and other locations aboard ship where sudden egress during a fire may be required. Although EEBAs are not required equipment, ships having them in their inventory are required to maintain and service them according to the manufacturer's recommended policy. EEBAs

shall be NIOSH/MSHA or Navy approved.

9.13 Lifesaving Equipment Test and Inspection: The following tests and inspections of lifesaving equipment shall be conducted:

9.13.1 Inflatable Liferaft Overhaul

Inflatable liferafts shall be serviced at an approved servicing facility (see USCG COMDTINST M16714.3, "Equipment List") every 12 months. The period for servicing is computed from the date of the last servicing. Except in emergencies, no servicing should be done aboard vessels. If at any time external damage is found to the container or straps, or if the seal is broken, the rafts shall be serviced by an approved servicing facility. After each servicing, the date, port, and initials of the inspector are to be stamped on the metal tag. The dates of the more extensive 5-year servicing shall also be clearly marked on the liferaft servicing tag.

9.13.2 Hydrostatic Release Overhaul

A hydrostatic release used in the installation of any inflatable liferaft, life float, or buoyant apparatus shall undergo periodic servicing and testing, normally every 12 months from the date of installation, as determined by its inspection tag. The spring of a spring-tensioned gripe used in such an installation shall be renewed when the accompanying hydrostatic release is serviced and tested.

Sealed disposable hydrostatic releases are approved for use and have a service life of 2 years from their date of installation. These hydrostatic releases shall be disposed of after reaching their expiration date.

9.13.3 PFD/Survival Suit/Work Vest/Float Coat Inspection

Each unit shall be examined annually to determine its serviceability. If not in serviceable condition, the PFDS and work vests shall be destroyed and removed from the vessel. Any survival suit or float coat that is not serviceable shall be returned for service. Any hardware attached to a survival suit shall not impede the safe operation of the suit or cause any external damage.

9.14 Other Safety Equipment Applicable To Class A Vessels

In addition to the equipment specified in other sections of this manual, each Class A craft shall be equipped with:

9.14.1 USCG approved Visual Distress Signals

These may be:

9.14.1.1 Pyrotechnic (Day and Night) - At least three of each. These may be hand held or aerial flares or hand held or floating smoke; and/or

9.14.1.2 Non-pyrotechnic devices such as (1) An orange distress flag; (2) An electric distress light that automatically flashes SOS; or (3) Mirrors.

9.14.2 Fire extinguishers

The number and type of USCG approved fire extinguishers required for powered Class A vessels with no fixed fire extinguishing equipment in a machinery space is:

9.14.2.1 Less than 16 Feet - One 1 B-I
9.14.2.2 16 to 26 Feet- One 1 B-I
9.14.2.3 26 to 40 Feet- 2 B-I, or 1 B-II
9.14.2.4 More than 40 Feet - 3 B-1, or 1 B-1 and 1 B-II.

9.14.3. Operable navigation lights

Red and Green bow lights and a White stern light.

9.14.4 Bailing Device

An effective bailing device, in addition to any installed electric bilge pumps.

SECTION 10 - NAVIGATION AND COMMUNICATION EQUIPMENT

10.1 Navigation Equipment

10.1.1 Class C and Class B Vessels >65': The Master should ensure that this class vessel has all the necessary charts and navigation equipment to safely navigate the vessel as dictated by the waters to be navigated. As a general rule, this equipment should meet or exceed the navigation equipment requirements specified in SOLAS 1974, regulation 12 and 46 CFR, subpart 195.17, 195.19 and 195.27.

Note: The accuracy of the equipment necessary to document the vessel's location for science purposes may exceed the accuracy requirements for safe navigation. When practicable, if such equipment is installed, it should be rigged to also facilitate the navigation of the vessel.

10.1.2 Class A and Class B Vessels <65': As above, the Master should ensure that these classes of vessels have all the necessary charts and navigation equipment to safely navigate the vessel as dictated by the waters to be navigated and the limitations of the vessel. As an absolute minimum, these vessels shall have current charts of the waters to be navigated and a calibrated compass if the vessel may pass out of sight of land.

Note: At the risk of overstating the obvious, "out of sight of land" is a function of distance, height above the water, and visibility.

10.2 Communications Equipment

10.2.1 Class C and Class B Vessels >65': The Master should ensure that this class vessel has all the necessary communications equipment to maintain reliable communications as dictated by the distances and locations involved. To that end, the following is offered as general guidance.

10.2.1.1 VHF Radiotelephone Station (Bridge-to-Bridge Radio). These classes of EPA vessels should be fitted with a VHF radiotelephone in accordance with the provisions of regulation 17 of Chapter IV of SOLAS 1974. This equipment shall be for the use of the vessel's Master, or person in charge of piloting or directing the vessel's movements.

10.2.1.2 Radio Direction-Finding (RDF) Equipment. RDF is of value both as a navigational instrument and as an aid to locating ships in distress. EPA vessels equipped with radio direction finding equipment must possess and have posted in the area of the RDF a valid calibration chart. Calibration must be performed after

initial installation, and verified at yearly intervals by check bearings. Records of the check bearings must be kept on board the vessel for a period of not less than a year.

10.2.1.3 HF Radiotelephone Station. These classes of EPA vessels should be fitted with an HF radiotelephone in accordance with the provisions of regulations 15 and 16 of Chapter IV of the "International Convention on Safety of Life at Sea (SOLAS) 1974." Class B Vessels, 65' or less in length, that do not undertake voyages of significant distance and time or those in areas of nonhazardous navigational conditions, may not require this equipment.

EPA vessels with a HF radiotelephone station shall display the radiotelephone distress procedure in full view of the radio operator.

10.2.1.4 Emergency Position Indicating Radio Beacons (EPIRBs) and Emergency Radio. EPA vessels should carry one Class A EPIRB (float free, transmit only). In addition, all ships should have one Class B EPIRB (mechanically switched, transmit only) for each life raft carried. EPIRBs shall be stored in spaces accessible to vessel's personnel, such as on the bridge and near life raft stations. These devices shall be tested monthly to manufacturer's specifications and Federal regulations. EPIRB's may be tested only during the first 5 minutes after the hour and in test bursts not to exceed 1 second or 3 audio sweeps in duration whichever is less. Testing more frequently than once a month is not advised. Tests shall be recorded in the radio/maintenance log. Battery expiration dates must be displayed on the outside of the battery. EPIRB's shall be permanently marked with the vessel's name.

10.2.1.5 Emergency Radio AN/PRC-96 VHF/AM. One AN/PRC-96 VHF/AM Emergency Radio. This radio shall be capable of transmitting signals complying with the relevant standards and recommended practices of the International Civil Aviation Organization on the frequencies 121.5 MHz and 243.0 MHz. The PRC-96 shall be powered by lithium batteries. One battery shall be installed in the radio and two stored in the carrying case as reserves. Batteries must be replaced 3 years from date of manufacture. Emergency radio must be tested monthly and recorded in the radio/maintenance log.

10.2.1.6 Radiotelephone Auto Alarm Generator/Transmitter. For Class C Vessels - A Radiotelephone Auto Alarm Generator I Transmitter that meets the requirements of 47 CFR, Chapter 1, section 80.221 and 80.855. This auto alarm transmitter shall be tested quarterly and recorded in the radio/maintenance log.

10.2.1.7 Watch Receiver. For Class C Vessels - A Watch Receiver that meets the

requirements of 41 CFR, Chapter 1, section 80.269. This watch receiver shall be tested quarterly and recorded in the radio/maintenance log.

10.2.1.8 Ship Satellite Communications. International Maritime Satellite Organization (INMARSAT) communication systems have been installed on several EPA vessels. INMARSAT should be used to supplement HF and VHF communications during times of distress or medical emergency, particularly in times of bad weather or local interference. Only INMARSAT-type approved ship-earth stations are to be installed on EPA vessels. These earth stations will be commissioned in accordance with INMARSAT commissioning procedures for Standard-A-Ship-Earth Stations.

10.2.1.9 Portable Emergency Lifeboat Transceiver. An approved portable radio transceiver for survival craft shall be carried on all EPA vessels. The equipment shall be kept in the chart room or other suitable place ready for transfer to a boat or life raft in the event of an emergency. Instructions to the crew in its use shall be provided during abandon-ship drills. Equipment must be tested quarterly and recorded in the radio/maintenance log. This equipment shall be capable of operating at the following frequencies: 500 kHz, 2182 kHz, 8364 kHz.

10.2.1.10 Radiotelephone Equipment. Radiotelephone equipment should be provided for communication between survival craft, between survival craft and vessel, and between vessel and small boats operating off the main vessel. Such small craft shall be provided with a two way radiotelephone. This requirement may be complied with by using on-board walkie talkies for communication on a common frequency other than VHF Channel 16. The radio should:

- Be designed for use by an unskilled person in an emergency
- Be portable and capable of use for on-board communications (in a lifeboat/liferaft).
- Conform to requirements stipulated in the relevant International Telecommunication Union Radio Regulations for equipment used in the maritime mobile service for on-board communications and shall be capable of operation on those channels specified by the radio regulations. If the equipment is operated in the VHF band, precautions shall be taken to prevent the inadvertent selection of VHF channel 16 on equipment capable of being operated on that frequency.
- Be operated from a battery of adequate capacity to ensure four hours of operation with a transmit to receive ratio of 1:9.
- Be maintained in operational condition, and the battery shall be maintained in a fully-charged condition or replaced.

10.2.2. Class A and Class B Vessels <65': As above, the Vessel Management Official and Master should coordinate to ensure that these classes of vessels have all the communications gear necessary for reliable communications as dictated by the operations and the distances and locations involved.

SHEMD strongly recommends that the operator's of all small craft, even on in-land waters, be equipped with a reliable means to summon assistance, e.g., a VHF hand held radio or cell phone, as dictated by local communication conditions.

10.3 On-Board Communications and Alarm Systems

The following equipment is required on all EPA Class C and Class B Vessels > 65'. Vessel Management Officials may require this equipment on smaller vessels based on their design and operations.

10.3.1 Emergency Communications. Two-way communications between emergency control stations, muster and embarkation stations and strategic positions on board the vessel shall be provided. These two-way communications can be comprised of either fixed or portable equipment.

10.3.2 General Alarm. A general emergency alarm system shall be provided for summoning the crew to muster stations and to initiate the actions included in the muster list. The system shall be supplemented by either a public address system or other suitable means of communication.

10.4 Emergency Power: EPA vessels with an emergency generator must have the following radio and navigation equipment, if installed, powered by the emergency power source:

10.4.1 Bridge-to-bridge VHF radio
10.4.2 1 kW HF radio* (100 or 150 Watt radio for those ships not equipped with a 1 kW radio)
10.4.3 Distress alarm generator/transmitter (100/150 W)
10.4.4 Gyrocompass
10.4.5 LORAN
10.4.6 Bridge sounder
10.4.7 Radar
10.4.8 RDF
10.4.9 INMARSAT
10.4.10 Charging panel for general alarm batteries
10.4.11 General alarm

10.5. <u>Radio Watches and Logs</u>: The following is required on all EPA Class C and Class B Vessels > 65'. Vessel Management Officials may require these procedures on smaller vessels based on their design and operations.

10.5.1 HF Radiotelephone Watch. Each vessel that is fitted with a HF radiotelephone must, for safety purposes, carry at least one radio telephone operator (who may be the Master, an officer, or a member of the crew properly trained in radiotelephone procedures). Further, while at sea, each vessel must maintain continuous watch on the radiotelephone 2182 kHz distress frequency by the bridge watch. Equipment used to maintain this watch shall consist of a radiotelephone distress frequency watch receiver, a loudspeaker, and a radiotelephone auto alarm device.

10.5.2 VHF Radiotelephone (Bridge-to-Bridge Radio) Watch. EPA vessels, while underway, must maintain a continuous guard on VHF Channel 16 (156.8 MHz) distress and Channel 13 (156.65 MHz) or other locally applicable Coast Guard assigned vessel control frequency. Continuous watch shall be maintained on the bridge by means of dual receivers, except while handling traffic on other VHF frequencies.

10.5.3 Vessel Radiotelephone Log. All entries shall be logged, dated, and signed by the individual using the radio or performing the maintenance and test functions. The following information must be logged:

10.5.3.1 All distress and alarm messages transmitted or received and all related communications transmitted.

10.5.3.1 All HF communications between the vessel and land or mobile stations, including frequencies used and duration.

10.5.3.2 The times at which the listening watch on maritime mobile radiotelephone distress frequencies begins when the ship leaves port and ends when the vessel reaches port.

10.5.3.3 The beginning and ending times, together with the reason, for any periods over 10 minutes at sea during which a listening watch is not maintained on the distress frequency.

10.5.3.4 All tests and maintenance conducted on equipment used for emergency and distress transmission or reception. The model and serial number of the equipment must also be logged.

10.5.3.5 All tests and maintenance on portable radio equipment for survival craft. The model and serial number of the equipment must be logged.

Radiotelephone logs are retained for at least 1 year, and for 3 years if they contain entries concerning distress or disaster action.

10.5.4 INMARSAT Log. A satellite communications log shall be maintained aboard each EPA vessel having an INMARSAT system installed. All entries shall be dated and signed by the individual using the system. The following information shall be logged:

10.5.4.1 Who placed the call,
10.5.4.2 Destination and number called,
10.5.4.3 Purpose of the call, and
10.5.4.4 Call duration.

10.6. Radio Frequency (RF) Radiation Hazards: As appropriate to the installed equipment, the following safety precautions shall be followed to reduce the hazards presented by RF radiation.

10.6.1 All 1 kW HF transmitters shall be secured while cranes or booms are in operation. This restriction shall be clearly posted at the HF radio operating station. Burn hazard warning signs shall be posted on cranes and booms.

10.6.2 All 1 kW HF transmitters and radars shall be secured while refueling operations are underway.

10.6.3 Personnel in the vicinity of HF antennas shall be warned when HF transmitters are transmitting.

10.6.4 Minimum safe distances from sources of radiation, as established by a radiation safety survey, shall be adhered to.

10.6.5 Protective barriers shall be installed around 1 kW and 100/150 W HF transmit antennas, antenna I coupler connections, and antenna lead-ins to prevent accidental personnel contact. Barriers shall either consist of a life rail or a chained-off area, positioned 4 feet from the hazard, or a protective cage mounted in such a way as to prevent physical contact with the hazard. Antenna/coupler installations in the vicinity of inflatable liferafts, search lights, signal lights, or other work areas where a life rail or chain will not prevent accidental contact by personnel, must have protective cages installed. Radiation and burn hazard warning signs shall be installed on the barrier. A burn hazard warning sign shall also be installed on the coupler. For best transmission characteristics, the barrier should be constructed of kevlar or glass reinforced plastic. If a metallic barrier is used, it must be thoroughly grounded to prevent the build up of induced RF voltage.

10.6.6 Access to HF locations shall be restricted and RF hazard warning signs shall be posted at all access points. (e.g., ladders and steps leading to the flying bridge.)

10.6.7 Signs warning of a "RF BURN HAZARD" shall be posted in the vicinity of cranes, booms and boat davits shown to be potential burn hazards by a radiation safety survey.

SECTION 11 - HEAVY WEATHER

11.1 Discussion

Heavy weather is any weather condition that results in high winds, extreme sea states, and heavy rain, snow and/or hail. Weather of this type can result in extremely uncomfortable conditions on board the vessel. Additionally, excessive rolls, yaws, pitches, coupled with taking on water can increase the risk of the scientific work being performed as well as normal working and living activities.

Many hazards can occur in heavy weather. Objects can slide or fall on personnel, causing injury. Personnel can fall into machinery or equipment. Personnel working exposed to the weather can be washed overboard or against fixed objects. Heavy weather is as dangerous now as it was during the days of sail, and all personnel must be aware of potential hazards and safety requirements.

11.2 EPA Class A Vessel Weather Restrictions: The following weather restriction is applied to decrease the potential risks associated with smaller EPA vessels encountering heavy weather. Class A Vessels should not depart if a Small Craft Advisory (Winds 18-33 Knots or hazardous waves) is in effect on the body of water involved, and they should make for a safe haven at once if such an advisory is issued while they are underway. To that end, persons operating such craft should receive a weather forecast before operations commence, and maintain a listening watch if adverse weather conditions are expected.

The operators of these vessels are counted upon to not "push" to complete the mission in the face of adverse weather.

11.3 Safety Precautions During Heavy Weather Conditions: The following is offered as a general review of some of the steps that can be taken to reduce risk during heavy weather conditions. As weather conditions, crew experience, and vessel design and capabilities vary widely, the Master of the vessel must decide the proper steps to take as dictated by the conditions at hand.

11.3.1 General:

11.3.1.1 Be aware of stowage locations of all equipment necessary for rigging heavy-weather life-lines.

11.3.1.2 Inspect tie-down equipment such as cables, turnbuckles, deck pads and bolts at frequent intervals to ensure their security.

11.3.1.3 Only use the fittings provided on the equipment to be transported to secure the item to the ship.

11.3.1.4 Do not use excessive force to place a tie-down onto a fitting.

11.3.1.5 Ensure that the arrangement of individual tie-down assemblies are in strict conformance with design requirements.

11.3.1.6 Ensure that when lashing and tie-down equipment is not in use, it is stowed in its proper location.

11.3.2 Life-Lines:

11.3.2.1 Keep life-lines or rails rigged at all times along all boundaries. Keep permanent life-lines in good repair.

11.3.2.2 Keep unguarded openings adjacent life-rail or life-line sections or an end section and adjacent structures to a minimum and in no case greater than five inches.

11.3.2.3 Wherever life-lines or life-rails and safety nets are installed adjacent to one another, ensure that a safety net overlaps the area protected by life-lines or life-rails by a minimum of three feet or the space between the lowered safety net frames and the life-lines or life-rails is fitted with a section of safety netting.

11.3.2.4 Keep clear of the life-lines when maneuvering alongside a dock or during drills.

11.3.2.5 Use portable single life-lines. These lines shall be set up along one side of walkways in traffic areas of weather decks which are subject to green seas or areas which are not provided with life-lines, grab rails, or equivalent means of safety within reasonable accessibility of the walkways.

11.3.2.6 Ensure life-line netting (snaking) or life-lines are installed along the weather decks of vessels subject to green water from heavy seas.

11.3.2.7 Do not dismantle any life-line on the vessel without specific permission of the officer of the deck and then only if temporary life-lines are rigged before dismantling.

11.3.2.8 Inspect life-lines daily for proper installation and material condition. Report any unsafe conditions to the immediate supervisor and correct immediately.

11.3.2.9 Keep weather decks which are subject to seas, clear of personnel except

those required for urgent duties. Pass word to this effect during heavy weather. Publicize locations where entry is forbidden.

11.3.3 Tie-Downs:

11.3.3.1 Use tie-downs or lashing to secure moveable shipboard items, such as deck cargo, against the motion of the vessel and exposed areas against the forces of wind and waves.

11.3.2.2 Seize or tie-down shackles, hooks, turnbuckles, and release devices to prevent working loose. Check them for security more frequently in heavy weather.

11.3.4 At Sea:

11.3.4.1 Secure all booms, brace skids as necessary, secure all cargo, stow and lash down all movable equipment and covers. Rig in ready life boats and gripe down, and add heavy weather gripes to these and other types of boats.

11.3.4.2 Close all unnecessary topside hatches and access openings and be prepared to close off ventilation openings.

11.3.4.3 Station anchor detail if the vessel is in dangerous waters.

11.3.4.4 Inspect all life-lines and rig additional lines as required for topside safety.

11.3.4.5 At all times, wear a standard safety harness which shall be attached to the life-line by means of the "D" rings provided on the belt. An inherently buoyant life jacket shall be worn over the safety harness. Safety helmets with chin straps secured shall also be worn.

11.3.4.6 Use a minimum of two people when required for a weather deck detail and send them out only when necessary.

11.3.4.7 Remain below deck unless required to be topside to perform essential duties.

11.3.4.8 Do not go topside without permission of the officer of the deck

11.3.5 At Anchor:

11.3.5.1 Hoist in all boats.

11.3.5.2 Check ship for loose gear, proper lashings, or movable equipment and covers.

11.3.5.3 Take in gangway.

11.3.5.4 Close all unnecessary topside access openings, and set material condition yoke to ensure maximum watertight integrity below the water line.

11.3.5.5 Station anchor watch.

11.3.5.6 Be prepared to veer chain or put out another anchor if available.

11.3.5.7 g. Keep detachable link in position so that anchor may be slipped if necessary. Have detachable-link tool kit available.

11.3.6 Moored to a Pier or Ship:

11.3.6.1. Place an anchor under foot.

11.3.6.2. Stow all loose gear and properly lash down all movable equipment and covers.

11.3.6.3 Close all unnecessary topside openings.

11.3.6.4. Check all mooring lines and remove the slack to keep the movement of the ship to a minimum.

11.3.6.5 Lines tending in the same direction should be made to take the strain simultaneously. When slacking lines, attempt to slack all lines taking a strain at the same time in order to prevent a line from taking undue strain and parting.

11.3.6.6 Be prepared to put out additional lines or wires.

11.3.6.7 Place fenders along the hull at frame locations (fenders located on shell plating between frames will not protect sides from damage).

11.3.6.8 Be prepared to get underway.

SECTION 12 - POLLUTION CONTROL

12.1 Purpose

This section sets forth the policy, standards, procedures, and equipment requirements for all EPA vessels concerning the transfer and/or disposal of oil and oily waste. Solid waste (garbage), sewage, and medical waste abatement and control has been a continuing concern of the EPA. These concerns are expressed in paragraph B, Background. This section, Pollution Control will be updated and redefined with specific EPA vessel requirements policy as indicated. Since the EPA is empowered by congress to establish acceptable pollution standards, it is incumbent upon all EPA vessel managers to set an example of compliance with these pollution abatement objectives aboard EPA owned vessels with a positive and willing determination.

12.2 Background

12.2.1 International concern of marine pollution culminated in development of the International Convention for the Prevention of Pollution from Ships (1973) and its Protocol, known collectively as MARPOL 73/78, under the auspices of the International Maritime Organization (IMO). MARPOL currently includes five annexes; Annex I (Oil), Annex II (Noxious Liquid Substances), Annex III (Packaged Goods), Annex IV (Sewage), and Annex V (Garbage). Still under development is Annex VI (Air Pollution).

12.2.2 The EPA participated in an extensive study and survey with the USCG, NOAA and other government agencies and private industry, to the Committee on Shipboard Waste, Marine Board, Commission on Engineering and Technical Systems of the National Research Council. This study resulted in an extensive report "Clean Ships, Clean Ports, Clean Oceans." The study was predominately concerned with implementation of Annex V. The committee concluded that:

12.2.2.1 There is a need to assure accountability of both vessel operators and port operators;

12.2.2.2 Vessel recycling programs need to be promoted; and

12.2.2.3 The EPA is the logical agency to establish the overall frame work for improving the vessel/shore interface, due to its expertise in and authority for national management of solid waste.

12.3 EPA Vessel Operating Policy

12..3.1 All EPA vessels operating on the Great Lakes will be "zero

discharge" vessels. No solids or liquids of any sort will be discharged from the vessel into the lake waters. Accordingly, at sea time to accomplish scientific missions is limited to the holding capacity of the vessel. The objectives stated above regarding reduction of waste material on board should be vigorously pursued.

12..3.2. EPA Class B vessels not operating on the Great Lakes will be zero discharge of all solids including garbage of any sort, and will comply with USCG and local laws governing sewage discharge.

12..3.3 EPA Class C vessels not operating on the Great Lakes will strive to meet the EPA objectives stated above (& B.2. a-c), but at a minimum comply with the current referenced regulations.

12.4 Oily Waste Pollution Standards and Equipment Requirements

Applicability - Class C vessels not operating on the Great Lakes:

12.4.1 Ensure that any oily discharge from the vessel does not exceed 15 parts per million (ppm).

12.4.2 When discharging bilges or oily ballast overboard, have in operation an oily water separator (OWS) capable of producing a discharge with oil concentrations less than 15 ppm and a sensor in the discharge line of the OWS that alarms when the concentrations exceed 15 ppm; or

12.4.3. Retain all oily wastes on board for discharge ashore.

12.5 Requirements for Fuel Oil Transfer Operations

Applicability - Class B vessels over 65 feet and Class C Vessels:

12.5.1 The vessel Chief Engineer, under the direction of the Master shall ensure that fuel oil transfer procedures, precautions and preparations, as set forth below, have been met before beginning fuel oil transfer operations. These requirements are based on 33 CFR 155, 156.

12.5.2 Fuel Oil Transfer Procedures. The vessel Master shall establish and maintain current written fuel oil transfer procedures and ensure they are used during each oil transfer operation. A legibly printed copy of the procedures should be posted or available at a place where the procedures can be easily

seen and used by those crew members engaged in the transfer operation.

12.5.3 The Chief Engineer shall designate a person or persons to be in charge of each oil transfer to or from the vessel, from tank to tank within the vessel, and for each vessel cleaning operation. No person shall be so designated without having been instructed in the duties or without having a thorough knowledge of the oil transfer system, oil transfer procedures, and Federal water pollution laws and regulations applicable to the vessel.

12.6 Ship Fuel Oil and Lubricating Oil Handling Equipment: Discharge Containment Provisions

Requirements for the containment of accidentally discharged fuel oil or lubricating oil through tank vents, overflows, and fill pipes during oil transfer operations as detailed in 33 CFR 155.320.

Applicability - Class B vessels over 65 feet and Class C vessels:

12.6.1 Each vessel shall have a fixed container or enclosed deck area under or around each fuel oil or bulk lubricating oil tank vent, overflow, and fill pipe that has a capacity of at least one-half barrel (21 gallons); or

12.6.2 The vessel shall equip each fuel oil or bulk lubricating oil tank vent, overflow, and fill pipe during oil transfer operations with a portable container of at least a 5 U.S. gallon capacity. It is suggested that plastic refuse containers secured under the pipes during fueling operations will, in most cases, meet this requirement.

12.7 Oil Discharge Placard

Applicability - All EPA Class B and C Vessels.

Per 33 CFR 155.450, each vessel must have a placard of at least 5 by 8 inches, made of durable material, fixed in a conspicuous place in each machinery space, or at the bilge and ballast pump control station, stating the following (or similar wording):

DISCHARGE OF OIL PROHIBITED

The Federal Water Pollution Control Act prohibits the discharge of oil or oily waste into or upon the navigable waters of the United States, or the waters of the contiguous zone, or which may affect natural resources belonging to, appertaining to, or under the exclusive management authority of the United States, if such discharge causes a film or discoloration of the surface of the water or causes a sludge or emulsion beneath the surface of the water. Violators are subject to substantial civil penalties and/or criminal sanctions including fines and imprisonment.

12..8 Oil Pollution Reporting

Applicability - All EPA Vessels.

Federal regulations contained in 33 CFR, require that *any* spill of petroleum or hazardous materials be reported to the Coast Guard. Accordingly:

12.8.1 In the event of a spill, notify the nearest Coast Guard Marine Safety Office, or call the Coast Guard National Response Center, toll-free, at: 1-800-424-8802.

12.8.2 Spills reported to the USCG will also be reported, through the involved managers, to SHEMD.

12.8.3 A written notice shall be available in the pilot house detailing specific instructions in the event of an oil spill.

12.9 Sewage Pollution Control

Applicability - Class B and C vessels not operating on the Great lakes.

No discharge of sewage within three nautical miles of nearest land is permitted unless the ship is fitted with, an approved Type II MSD, or an approved Type III MSD, in accordance with 40 CFR 140.

12.10 Refuse Pollution Control

Applicability - Class C vessels and Class B Vessels with a laboratory aboard.

To provide a systematic approach to the control of overboard trash and garbage in the marine environment, and to be consistent with the objectives outlined in paragraph B, Background:

12.10.1 A Garbage Management Manual will be prepared, vessel specific, to conform to the MARPOL 73/78, Annex V, requirements.

12.10.2 Included will be laboratory and medical waste pollution control requirements. As a general rule, no laboratory waste materials will be sent overboard - Instead, they will be returned to shore as waste.

12.10.3 The manuals prepared will be submitted to SHEMD for approval.

12.11 References

- 33 CFR 151, Oil Pollution Regulations
- 33 CFR 155, Oil Pollution Prevention
- 33 CFR 159, Marine Sanitation Devices
- 33 USC 407, The Refuse Act of 1899
- 33 USC 2501, U.S. Public Vessel Medical Waste Anti-dumping Act of 1988
- International Maritime Organization (IMO) (MARPOL 73/78) Annex I, Regulations for the Prevention of Pollution by Oil
- IMO (MARPOL 73/78) Annex IV, Regulations for the Prevention of Pollution by Sewage from Ships
- IMO (MARPOL 73/78) Annex V, Regulations for the Prevention of Pollution by Garbage from Ships

SECTION 13 - ON-BOARD SAFETY REQUIREMENTS

13.1 Vessel Safety Familiarization

13.1.1 Applicability

This element is applicable to EPA Class B and C Vessels.

13.1.2 Purpose

The purpose of this element is to provide a means for crew members, and scientific staff to review the basic safety requirements for vessel operations.

13.1.3 Program Elements

13.1.3.1 Familiarization Guide

Appendix A of this manual contains a safety familiarization guide that addresses safety issues applicable to all EPA vessels with a laboratory aboard. Also, portions of the guide are generally applicable to EPA Class B Vessels that do not have a laboratory aboard. The guide was adapted from Chapter 1, of the Safety Training Manual - Crew Supplement prepared by the UNOLS Research Vessel Operators Committee. It provides basic safety information for those crew members and scientists who are serving aboard an EPA vessel for the first time.

Each Class B and C EPA Vessel shall have sufficient copies of the guide to provide one to each new crew member and members of the scientific staff who have not previously embarked on the vessel. The vessel Master may choose to use the guide as written, or they may prepare a vessel specific guide that includes the same categories of material.

The guide does not replace the requirement to prepare Station Bills, or the need to conduct emergency drills as required by other sections of this manual.

13.1.3.4 UNOLS Safety Training Manual

The UNOLS Safety Training Manual - Crew Supplement, was prepared to provide more in-depth coverage of the safety issues associated with science vessels. A copy of the manual is recommended for inclusion in the library of each Class C Vessel, and Class B Vessels that have a laboratory aboard.

13.1.4 Program Responsibilities

13.1.4.1 Master

The Master of each applicable EPA vessel shall ensure that there are sufficient copies of the guide aboard to provide one to each new crew member and new members of the scientific staff who have not previously embarked on the vessel.

13.1.4.2. New Crew members

To help ensure their safety while aboard, each new crew member should read the guide and ensure that they understand the basic principles as well as their individual responsibilities for their personal safety and the safety of other crew and the vessel. Questions should be directed to the Master or the Chief Scientist, as appropriate.

13.2 Scientific Diving Operations

13.2.1 Applicability

This element is applicable to all categories of EPA vessels from which scientific diving operations are conducted. It does not apply to commercial diving activities conducted in support or maintenance of EPA vessels. These commercial diving activities are, instead, covered by the provisions of OSHA's Commercial Diving Standard, 29 CFR 1910.401-442.

Note: The EPA diving program is based on the exceptions, and requirements, set forth in the Commercial Diving Standard for scientific diving, that states, in part, *"Scientific diving means diving performed solely as a part of scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks. Scientific diving does not include performing any tasks usually associated with commercial diving such as: placing or removing heavy objects underwater; inspections of pipelines and similar objects; construction; demolition; cutting and welding; or the use of explosives".*

Accordingly, activities such as clearing a vessel's fouled anchor or propeller and vessel repair are not covered by the EPA diving program.

13.2.2 Purpose

EPA scientific diving operations are conducted under the requirements set forth in the EPA "Diving Safety Manual - Version 1.0", dated August, 1997. The purpose of this section of the vessel safety manual is to establish criteria to ensure that EPA vessels, and assigned crew, are qualified and equipped to support scientific diving operations conducted in accordance

with the EPA Diving Safety Manual.

13.2.3 Program Elements

13.2.3.1 Procedures

These procedures are based on the fact that the Master of the vessel retains ultimate authority for all diving operations conducted from the vessel, which includes terminating all diving operations if, in the Master's judgment, conditions endanger the vessel or personnel. In practical terms, and to minimize risk, this means that the approval of two persons are required to commence a dive operation - The Master of the vessel and the Divemaster. Either one of these responsible individuals can terminate a dive operation.

As different types of diving operations may be performed from many different types of EPA vessels, it is very important that the Divemaster and the vessel's Master fully understand what is to be accomplished and the characteristics of the involved vessel - to include any limitations. Accordingly, the following procedures are general in nature:

13.2.3.1.1 Dive Plan At least two weeks prior to embarking on a dive operation, the Divemaster will provide the Master with a dive plan for his or her coordination. From an EPA vessel perspective, the dive plan will include at least the following information:

13.2.3.1.1.1. Location(s) and date(s) of the dive(s);

13.2.3.1.1.2 Number and organizational make-up of the dive party (It is also important for the Master to know if other agency reciprocity personnel are included);

13.2.3.1.1.3 The identification of potential hazards;

13.2.3.1.1.4 The identification of potential sources of pollution;

13.2.3.1.1.5 A description of the expected environmental conditions, e.g.:

- Tidal heights;
- Water currents;
- Expected water temperature;
- Maximum dive depths;

- Expected in-water visibility;
- Expected weather; and
- Expected boat/vessel traffic.

13.2.3.1.1.6 Equipment such as communications gear, SCBA air supply, gear storage space, small boat, etc., that the Master is expected to provide, and/or any other special requirements of the vessel or the vessel's crew.

If the Master perceives any problems with the dive plan, in particular with the expected location and expected environmental conditions, he or she will immediately notify the Divemaster.

13.2.3.1.2 Class B & C Vessels Pre-Dive Survey

If dives have not been previously accomplished from a particular EPA Class B or C vessel, a pre-dive survey will be completed by the Divemaster, in conjunction with the Master, prior to embarking on a dive cruise. The purpose of the pre-dive survey is to:

13.2.3.1.2.1 Ensure there is a practical and safe means for divers to enter the water and re-board the vessel while wearing SCBA;

13.2.3.1.2.2 Inspect, if provided by the vessel, the equipment for providing SCBA air;

13.2.3.1.2.3 Evaluate the means for signaling between the Master (and/or the Watch Officer) and the Divemaster - Evaluate also lines of site from the bridge to the diving staging area on the vessel (**Note**: The Master or watch officer must have a reliable means to provide a positive response before any diver leaves the vessel):

13.2.3.1.2.4 If the vessel's small boat is to be used to support the dive, examine the boat and ensure that it is equipped as necessary for the intended operation;

13.2.3.1.2.5 Evaluate the vessel's ability to provide for the emergency communications capabilities required by the EPA Diving Safety Manual;

13.2.3.1.2.6 Evaluate the vessel equipment, if any, required to support a diving emergency;

13.2.3.1.2.6 Evaluate available first aid supplies. - If additional, specialized, first aid supplies are required for the dive, it is the responsibility of the

Divemaster to ensure that they are brought aboard and are properly stowed; and

13.2.3.1.2.1 Identify applicable vessel equipment that should be secured and/or controlled during diving operations - For example:

- Rudder;
- Trash Disposal Unit;
- Tank Blows;
- Tank Vents;
- Propeller shaft(s);
- Sea Suctions;
- Sea Discharges;
- Under water (U/W) electrical equipment; and
- Other UW equipment - not listed.

13.2.3.1.3. Crew Procedures

The Master will ensure that procedures are developed and implemented to support the diving operation. These procedures should include:

13.2.3.1.3.1 Communications between the Divemaster and the Watch Officer;

13.2.3.1.3.2 A means to signal all crew, in particular the engine room, that diving operations will commence. The EPA Diving Manual prescribes the following announcement, which should be amended to address the equipment on specific EPA vessels:

"There are divers working over the side. DO NOT operate any equipment over the side, rotate screws, cycle rudder, take suction from or discharge to the sea, blow or vent any tanks, activate sonar or underwater electrical equipment, open or close any valves or cycle trash disposal units before checking with the Dive Master_____(Name)".

13.2.3.1.3.3 Procedures for the small boat operator, if applicable, including the means to communicate reliably with the Watch Officer. **Note:** Appendix B contains a safety plan for small boat operations, prepared by the crew of the EPA Vessel Peter W. Anderson, that should be used as a guide for this requirement;

13.2.3.1.3.4 Setting the required diving operation signals;

13.2.3.1.3.5 Crew member responsibilities in the event of a dive emergency;

13.2.3.1.3.6 Completion of the Dive Safe Ship Operations - Checklist (NOAA Form 64-3), required by Paragraph 13, Appendix A-2, of the EPA Diving Safety Manual. **Note:** A copy of this checklist is at Appendix B of this manual; and

13.2.3.1.3.7 Proper stowage of divers gear.

13.2.3.1.4 The following minimum list of equipment is required to support an EPA diving operation conducted in accordance with the EPA Diving Manual:

13.2.3.1.4.1 Dive operations signaling equipment for both national and international waters/or traffic;

13.2.3.1.4.2 Emergency communications gear that meets the communications requirements of the EPA Diving Safety Manual (e.g., Divers Alert Network and Medical Advisory System, etc.);

13.2.3.1.4.3 First Aid Equipment - Vessels will be equipped with the level of first aid equipment as set forth in this manual. If additional, specialized, first aid supplies are required for diving operations, it is the responsibility of the Divemaster to ensure that they are brought aboard and are properly stowed;

13.2.3.1.4.4 If applicable, a means of supplying diver's air that meets the quality specifications set forth in the EPA Diving Manual;

13.2.3.1.5 Training. Applicable crew members, as designated by the Master, will be provided sufficient training to enable them to carry out their responsibilities in support of EPA scientific diving operations from their vessel. This training will be documented in the ship's Log.

13.2.4 Program Responsibilities: While afloat, The Master has the ultimate responsibility and authority for the safe operation of the vessel and embarked persons, to include all scientific diving operations conducted from the vessel. To this end, the Master will ensure that he or she fully understands the proposed diving operation, and that the vessel is equipped, and the vessel's crew is prepared, to effectively support the operation.

13.3 Vessel Chemical Hygiene Plan (VCHP

13.3.1 Applicability

This element is applicable to all EPA vessels that have a laboratory aboard. This includes all laboratories internal to the vessel's original structure as well as van or container laboratories secured to a weather deck(s).

13.3.2 Purpose

The purpose of this program is to ensure that the safety measures required by the various EPA laboratories ashore, as set forth in their Chemical Hygiene Plans (CHP) required by 29 CFR 1910.1450, are integrated with and are carried over to laboratory operations afloat.

Further, the VCHP must address the additional and/or different risks associated with operating a laboratory on a vessel.

As determined by each Chief Scientist, the chemical hygiene plan required by this element may be:

- A stand-alone document for a specific EPA vessel; or
- An appendix or chapter in the laboratory's primary CHP.

Regardless of the method used, the document:

- Must address the specific design, installed equipment, and contemplated laboratory operations of the shipboard laboratory(s) on a specific EPA vessel;
- Should ensure that chemical exposures encountered on the vessel are considered in concert with exposures to the same individual(s) in their laboratory work ashore;
- Be reviewed, and approved, by the Master with respect to those issues that can effect the safety of the vessel and/or crew, e.g., amount and type of hazardous materials brought on board, Hazardous material storage procedures, etc; and
- Must be available on the vessel.

13.3.3. VCHP Elements

The following elements, included in most chemical hygiene plans ashore, are discussed from the perspective of the potential additions and/or the differences associated with operating a shipboard laboratory. Each Chemical Hygiene Officer should review this listing and make a decision regarding the relative effectiveness of preparing a stand-alone document for the

laboratory(s) on a specific EPA vessel or an appendix or chapter in the laboratory's primary CHP.

13.3.3.1 Chemical Hygiene Officer (CHO) - A CHO, who will be present during the cruise, should be appointed to provide expertise in areas of laboratory safety and industrial hygiene and to ensure that the requirements of the VCHP are carried out. The Chemical Hygiene Officer should be familiar with the vessel and vessel laboratory operations, and should report to the Chief Scientist.

13.3.3.2 Standard Operating Procedures (SOP**)** - Shipboard operations may require additional precautions, over operations ashore, such as handling acids in heavy seas, power interruptions, different equipment, exposures from sampling, equipment storage, emergency equipment, emergency evacuation, drills, etc.

13.3.3.3 Ventilation - The VCHP should address the differences in the ventilation systems on the vessel and how these differences may effect staff exposures, to include how and how often the system must be evaluated. Also, consider the effect of laboratory ventilation on non-laboratory areas of the vessel.

13.3.3.4. Spills - The clean up and disposal of spilled materials on a vessel present significantly different risk issues and should be addressed in the document.

13.3.3.5 Distribution and Storage of Hazardous **materials** - This is an area that can significantly effect the safety of the vessel and crew and should address specifically:

- The amount and type of materials to be brought aboard;
- Procurement and maintenance of a Material Safety Data Sheet (MSDS) for all hazardous materials brought on board. A copy of the MSDS must be furnished to the Master and a copy must be readily available to the scientific staff.
- The distribution of the material to be brought aboard, e.g., laboratory and storage area(s);
- Approval of storage areas;
- Segregation of materials;
- Security against moving and breakage in heavy seas;
- Labeling;
- Periodic inventories to ensure un-needed materials are not kept on board and/or are removed at the end of the voyage;
- On-board movement of materials in heavy weather, etc.

13.3.3.6 Environmental Monitoring - Differences between ashore and vessel monitoring requirements with respect to materials, hoods, ventilation systems, etc.

13.3.3.7 Protective and Emergency Equipment - Address the differences in equipment. For example:

- Location and type of drench-type safety shower(s) - And testing requirements;
- Location and type of emergency eyewash(s) - And testing requirements;
- Fire fighting systems (blankets, extinguishers, fixed systems, etc);
- Type and audibility of alarms and expected response (Include alarms associated with vessel operations and how various vessel emergencies may effect critical laboratory operations);
- Inter-vessel communications, e.g., intercom and telephones;

13.3.3.8 Records - Record keeping requirements afloat should be in consonance with, and support record keeping by the CHP - ashore, to include:

- Maintaining an accurate record of any measurement taken to monitor employee exposures and any medical consultation and examinations required by the basic CHP; and
- A system to maintain and transfer records to the ashore facility at the end of a survey voyage or trip.

13.3.3.9 Laboratory Waste Disposal - Prepare and enforce a written procedure for disposing of laboratory waste for the vessel, to include:

- Specifying how waste is to be collected, segregated, stored, and transported; and
- Precautions for use of sinks, sifting trays, etc.

13.3.3.10 Fume Hoods - Hoods should be selected, installed, operated, and maintained in accordance with the same criteria used in the laboratory ashore.

13.3.3.11 Respirator**s** - Respirators should be selected, used, and maintained in accordance with the same basic criteria used in the laboratory ashore - to include all medical approval and fit test requirements.

Important Note: When selecting respirators for use aboard an EPA vessel, the Chemical Hygiene Officer should also consider the environment that the respirator will be used in. For example, the effect of salt spray on a charcoal canister filter.

13.3.4 Program Responsibilities

13.3.4.1 The vessel's Master shall review and approve the VCHP with respect to

those issues that can effect the safety of the vessel and/or crew, e.g., amount and type of hazardous materials brought on board, Hazmat storage procedures, etc; and

13.3.4.2. The Chief Scientist Shall be responsible for ensuring that:

- A Chemical Hygiene Officer is appointed for the cruise;
- A VCHP has been prepared for the vessel that accurately and completely addresses the appropriate laboratory safety issues and is in consonance with the intended operations and the design and equipment of the vessel; and
- Scientific staff are familiar with the requirements of the VCHP and comply with it's provisions.

13.4 Tag Out

13.4.1 Applicability

This program is applicable to all EPA Class C Vessels.

It is also applicable to smaller EPA vessels, as deemed appropriate by the Regional Vessel Management Official, when application of the Tag Out Program will reduce the risk of EPA vessel operations and/or maintenance.

13.4.2 Purpose

The purpose of the Tag Out Program is to prevent injury to personnel and/or damage to equipment by notifying personnel that equipment or systems are not in a normal operating condition.

Very Important Note: This Program should not be confused with the Lock Out Tag Out Program (LOTO), which is covered in Section E., below. The use of tags or labels under this Tag Out program is not a substitute for the additional safety measures required under the LOTO Program, such as chaining or locking valves, removing fuses or racking out circuit breakers.

13.4.3 Program Elements

The Tag-Out Program consists of the following elements:

13.4.3.1 Use of Yellow Tags and/or Labels

The Tag-Out procedure consists of a series of yellow tags or adhesive labels that are applied, as appropriate, to equipment, switches, valves, instruments,

gages or meters to indicate that the equipment is inoperative, has restricted use, is out of calibration, etc. The yellow tags or labels, available from commercial sources, must contain the information necessary to avoid injury to personnel and/or damage to equipment.

Tag-Out procedures are to be used for all corrective maintenance including work done by an outside maintenance or repair activity.

Tag-Out procedures shall be enforced at all times.

All components necessary for the isolation of a system must be tagged. Only in this manner can safety to be assured. Once tags are attached, only authorized individuals may remove the tags and place the system back in operation.

13.4.3.2 Recordkeeping

A Tag-Out Log, indicating which equipment is tagged out, must be established for the vessel. The Log will include:

13.4.3.2.1 A listing of all disabled switches, valves, or other components;
13.4.3.2.2 The date on which the equipment was placed out-of-service, tag locations, valve/switch positions, and the name of the person who attached the tag(s);
13.4.3.2.3 The date on which the equipment was placed back in service and the tag(s) were removed - and the name of the person who removed the tag(s);
13.4.3.2.1.4 A section to document training on the Tag Out program.

13.4.3.3 Training. All hands must receive training on the Tag-Out program upon reporting aboard and annually thereafter. This training will be documented in the ship's Tag-Out Log. Additionally, scientific staff embarked must be familiar with the program as science related equipment, e.g., fume hoods, cranes, etc., may be involved.

13.4.4. Program Responsibilities

13.4.4.1 The vessel's Master shall ensure that all hands comply with the Equipment Tag-Out procedures.

13.4.4.2 The Chief Engineer Shall:

13.4.4.2.1 Manage the Tag-Out Program;

13.4.4.2.2 Establish and supervise a Tag Out Log and ensure that sufficient supplies of tags, labels and forms are available to properly execute the program; and

13.4.4.2.3 Personally check the Tag-Out Log at least once a month, note errors, bring errors to the attention of responsible personnel and remove completed Tag-Out Record Sheets and Instrument Logs.

13.5 Control of Hazardous Energy (Lock-Out-Tag-Out

13.5.1. Applicability

This program is applicable to all Class B and C Vessels. The requirements apply to the vessel crew, or the organization that provides maintenance for the vessel.

13.5.2 Purpose: The purpose of the Lock Out Tag Out (LOTO) Program is to prevent injury to personnel by ensuring that equipment that has been de-energized for maintenance cannot be inadvertently re-energized.

The LOTO process is the placement of a lock and red tag on the energy isolating device in accordance with an established procedure after the device has been de-energized. The presence of the lock and tag indicates that the energy isolating device shall not be activated until removal of the lock and tag takes place by the individual who was responsible for the initial placement. An isolating device can be an electrical circuit breaker, disconnect switch, a line valve, or similar device used to block or isolate energy.

The applicable OSHA Standard for Control of Hazardous Energy Sources is 29 CFR 1910.147. This element describes how this standard will be applied on EPA vessels.

Warning: Removing the power source from any type of equipment does not necessarily remove any energy that may be stored in the equipment such as electrical energy stored in a capacitor, kinetic energy stored in flywheels, mechanical energy due to pressure differences, heat energy and hot surfaces, and potential energy stored in pendulums, and heavy objects not at their lowest position. Therefore, it is imperative that crew members responsible for removing power sources are thoroughly knowledgeable of the system characteristics. Any stored energy should be released. If this is not possible, it should be controlled by blocking or other means and all persons that could be injured from such unexpected energy releases must be free and clear of the danger zones.

13.5.3 Program Elements

The LOTO Program consists of the following elements:

13.5.3.1. General Requirements

13.5.3.1.1 An initial survey of the vessel shall be made to identify all energy sources and related exposures to determine if machines, equipment, and processes can be isolated.

13.5.3.1.2 The requirements for red tags, chains, locks, adapters, pins, and the like, shall be ascertained, based on the initial survey, and an adequate supply shall be maintained, distributed or assigned as needs dictate.

13.5.3.1.3 The red tags used for this program shall be uniform throughout the vessel (i.e., size, shape, color, and format). Also, they shall be durable enough to withstand the environment to which they may be exposed for the maximum period of time that exposure is expected.

13.5.3.1.4 Red tags must warn against hazardous conditions if the equipment/process is re-energized and shall include the legends: **DO NOT START, DO NOT OPEN, DO NOT CLOSE**, or similar language.

13.5.3.1.5 Only the person who has locked out a piece of equipment is authorized to remove the lock. To assure compliance, only those employees actually engaged in the repair, maintenance or replacement of the equipment or process shall have the key to the locking device.

13.5.3.1.6 LOTO procedures are to be used for all corrective maintenance including work done by an outside maintenance or repair activity.

13.5.3.1.7 LOTO procedures must be enforced at all times.

13.5.3.1.8 All components necessary for the isolation of a system must be locked out. Only in this manner can safety be assured. Once red tags are attached, only authorized individuals may remove the red tags and place the system back in operation.

13.5.3.2 Procedures:

13.5.3.2.1 All Personnel affected by the LOTO shall be informed before the LOTO takes place.

13.5.3.2.2 Using appropriate equipment/process shutdown procedures, all

operating controls shall be turned off or returned to the neutral mode.

13.5.3.2.3 All involved energy isolating devices shall be located and operated in such a manner as to isolate the equipment or process from the energy source.

13.5.3.2.4 Appropriate locking devices shall be applied to each energy isolating control. The preferred method shall be by lockout and tagout. Tagout without lockout shall be considered only as a last resort. Lockout devices shall be attached in such a manner as to prevent the operation of energy isolating devices. Tagout devices shall be attached to the energy isolating device except, that where the installation does not permit this attachment, they shall be so located in such a manner as to be immediately obvious to anyone attempting to operate the energy isolating device. Where Lock Out tags are used, the crew member responsible for completing tag information shall include:

- Date and time of LOTO;
- Printed name of Crew member performing the LOTO; and
- Reason for LOTO.

13.5.3.2.5 Using due care, the following actions shall be taken after LOTO to determine if the operation of the energy isolating devices has, in fact, produced the required isolation of the equipment or process:

- Operate the equipment or process operating controls (push buttons, switches, etc.) to determine that the energy isolation has been effective, and
- Test the equipment or process by use of appropriate test equipment and/or visual inspection to determine that the energy isolation has been effective.

Warning: Return operating controls to off or neutral position after each test.

13.5.3.2.6 The equipment or process shall be carefully examined to detect and relieve, disconnect, or restrain any residual energy.

13.5.3.2.7 Where hydraulic, steam, water, pneumatic, gas, etc., isolation valves are involved, they shall be tightly closed, chained, locked and appropriately tagged.

13.5.3.3 Release of LOTO:

Warning: Energy stored in a locked or tagged out system must be considered prior to restoring the power to the system, regardless of the source. It is essential the involved crew member is well versed in the possibility of unexpected movement or power when the locking mode is removed.

13.5.3.3.1 Before energy is restored to the equipment/process, a visual inspection of the work area shall be made to ensure that all nonessential items have been removed and that all components are operationally intact. At this time, advise all affected personnel that locks and tags are to be removed for the purpose of restoring energy.

13.5.3.3.2 devices shall be removed from each energy isolating device by the individual who initially applied the device.

13.5.3.3.3 After ensuring that all affected personnel have been advised of the LOTO removal, restore energy to the equipment/process.

13.5.3.4. Record keeping. A LOTO log, indicating which equipment is locked out, must be established for the vessel. The Log will include:

13.5.3.4.1 The date and time on which the equipment was placed locked out and the name of the person who attached the locks and tag(s);

13.5.3.4.2 The date on which the equipment was placed back in service and the locks and tag(s) were removed - and the name of the person who removed the locks and tag(s);

13.5.3.4.3 A section to document training on the LOTO program.

13.5.3.5 Training. All crew members must receive training on the LOTO program upon reporting aboard and annually thereafter. This training will be documented in the ship's LOTO Log. Additionally, scientific staff embarked must be familiar with the program as science related equipment, e.g., fume hoods, cranes, etc., may be involved.

13.5.4 Program Responsibilities:

13.5.4.1 The vessel's Master shall ensure that all hands comply with the LOTO procedures.

13.5.4.2. The Chief Engineer Shall:

13.5.4.2.1 Manage the LOTO Program; and

13.5.4.2.2 Ensure that a sufficient supply of locks, locking devices and red tags are available to properly execute the program.

13.6 Confined Spaces

13.6.1 Applicability

This program is applicable to all EPA vessels that have a confined space capable of being entered.

13.6.2 Purpose

The purpose of this program is to ensure that no one enters or works in a confined space with an atmosphere that exposes a person to death, incapacitation, impairment of ability to self-rescue, or acute illness. By design, some vessels have confined spaces (especially tanks and voids) in which both toxic and non-toxic gas or vapor creating substances are used in the normal operation of the vessel, or that may accumulate as a result of system failures. Hazardous atmospheres may be created that can explode or cause asphyxiation. Compounding the problem is that many gases or vapors are not detected by the human ability of smell, and personnel attempting to save a fallen shipmate may themselves be overcome by undetected vapors. It is for these reasons that the atmosphere of every confined space must be tested before entry, and there must be an effective means of safe rescue immediately available.

This program element was developed from 29 CFR 1915, Subpart B - Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment, and is intended to describe the minimum requirements for EPA vessels.

13.6.3 Program Elements

The Confined Space Entry Program consists of the following elements:

13.6.3.1 Initial Survey and Marking: All EPA Class B and C Vessels will be surveyed to identify potential confined spaces (For example: tanks; voids; cofferdams; and double bottoms). The entry's to all such spaces, e.g., hatches, manholes, etc., will be labeled, "DANGER - CONFINED SPACE - DO NOT ENTER" in prominent letters. The remaining elements apply to entry into a confined space.

13.6.3.2 Entry Restrictions: In normal practice, entry to vessel confined spaces is a part of normal maintenance evolutions and should be conducted only while the vessel is along side a pier or in a yard. The purpose of this restriction is to conduct the entry only when competent technical advise and local rescue capabilities are readily available in the event of a mishap.

Confined space entries while underway shall be considered to be an emergency procedure, and shall be attempted only when the Master determines that such entry is necessary for the safety of the vessel.

13.6.3.3 Required Equipment: The following equipment is the minimum required for confined space entry:

13.6.3.3.1 Properly calibrated test equipment capable of measuring oxygen levels, flammable atmospheres, and any involved toxics;

13.6.3.3.2 Ventilation equipment capable of ventilating the confined space;

13.6.3.3.3 Rescue equipment suitable for rescue of an incapacitated person(s) in the space, from without the space, e.g., life line and harness, rescue tripod, etc; and

13.6.3.3.4 A means to communicate with the person(s) who enter a confined space.

13.6.3.4. Qualifications: Only the following persons are authorized to test and certify the atmosphere in a confined space on an EPA vessel:

13.6.3.4.1 A Marine Chemist;

13.6.3.4.2 A Certified Industrial Hygienist; or

13.6.3.4.3 A person designated by the Vessel Management Official as a "Competent Person". Competent Persons must be qualified IAW 29 CFR 1915.7

13.6.3.5 Procedures:

13.6.3.5.1 Ventilation - The space will be opened and ventilated to the outside atmosphere with a portable blower.

13.6.3.5.2 Testing - After ventilation, and prior to entry, the space

must be tested, in the following sequence

- Oxygen - A space will not be entered if the oxygen content is below 19.5% or above 22.0%
- Flammable Atmospheres - A space will not be entered when the concentration of flammable vapors or gases is equal to or greater than 10% of the lower explosive limit.
- Other - A space will not be entered until a competent person has determined that toxic vapors or gases do not present a dangerous atmosphere.

13.6.3.5.3 Certification - After testing, the person who performed the test will complete a "Gas Free Certificate" (Available from commercial sources). The certificate will be:

- Signed by the person who completed the tests;
- Signed by the person who will enter the space;
- Posted in plain view of the confined space entry point; and
- Retained by the Chief Engineer upon completion of the work.

13.6.3.5.4 Entry - Persons entering a confined space will be equipped with a harness and lifeline to facilitate rescue in the event of a mishap. At least one person will remain immediately outside the entry point to man the lifeline and communication system. If required, a tripod or chain hoist device will be immediately available to assist in any required rescue.

13.6.3.6 Training. The Chief Engineer is responsible for ensuring that personnel involved in confined space entry receive training upon reporting aboard and annually thereafter. Records of such training shall be maintained. Training will consist of at least the following topics:

- How to identify confined/enclosed areas.
- Hazards encountered when entering confined/enclosed spaces.
- Procedures for requesting gas-free testing.
- Procedures for helping shipmates in an emergency to include CPR. Training must stress to all personnel that if a person is seen unconscious in any space, no one is to enter that space without appropriate respiratory protective equipment and a backup assistant.

13.6.4. Program Responsibilities

13.6.4.1 If the vessel design is such that there are confined spaces where toxic and non-toxic gases may accumulate, the vessel's Master is responsible for a comprehensive confined-space entry program. The vessel's Master shall ensure that:

13.6.4.1.1 There is at least one trained, qualified and certified "Competent Person" on board.

13.6.4.1.2 Confined-space entry practices are established.

13.6.4.1.3 The program is evaluated annually for compliance and effectiveness.

13.6.4.2. The Chief Engineer shall ensure that:

13.6.4.2.1 Applicable crew members are trained concerning confined-space entry procedures and precautions. Additional support may be obtained from qualified marine chemists or industrial hygienists.

13.6.4.2.2 All entryways to confined spaces are properly labeled.

13.6.4.2.3. All equipment required for proper evaluation of confined spaces and rescue is aboard the ship, inventoried annually, and properly maintained.

13.6.4.2.4 Gas-free certificates are posted in necessary areas.

13.6.4.2.5 Records of gas-free space testing are kept.

13.6.4.2.6. Assigned personnel receive training on the confined-space entry program upon reporting aboard and annually thereafter.

13.6.4.3 All hands are responsible to ensure that:

13.6.4.3.1 The Chief Engineer is notified prior to entering any

unventilated, non-occupied space that has been designated to store hazardous or toxic materials or any sealed space.

13.6.4.3.2 The Chief Engineer is notified prior to conducting hot work on a bulkhead, deck, or overhead, adjacent to a space containing flammable or potentially explosive atmospheres (such as a fuel oil or contaminated holding tank).

13.6.4.3.3 Gas-free engineering certificates posted on spaces are complied with at all times.

13.6.4.3.4 Gas-free engineering retesting of spaces is accomplished prior to the end of the period for which a gas free certificate is valid. If a change is made to a space, the space shall be retested and re-certified prior to any additional work in the space.

13.6.4.3.5 Notify the Chief Engineer prior to entering any unventilated, non-occupied space designated to store hazardous or toxic materials or any sealed space. Verify that such a space was checked by a Competent Person prior to entry, and comply with the gas-free engineering certificates posted outside the space.

13.6.4.3.6 Notify the Chief Engineer before any new space is used to store hazardous or toxic material or of any spill of hazardous or toxic material.

13.7 Electrical Safety

13.7.1 Applicability

This element is applicable to all Class C EPA vessels.

Specific procedures should be written when using fish shocking equipment. .

13.7.2 Purpose

The purpose of this element is to provide guidance to assist in the identification of electrical hazards, and to prevent mishaps that could cause fatal injuries and extensive damage to shipboard equipment and compromise the ship's mission capabilities.

13.7.3. Program Responsibilities

13.7.3.1 The vessel's Master shall assign an electrical safety officer.

13.7.3.2 The electrical safety officer shall:

13.7.3.2.1 Ensure that this program is evaluated for compliance and effectiveness;

13.7.3.2.2 Provide electrical safety training;

13.7.3.2.3 Ensure that all electrical equipment (The vessels, scientific, or personal) received aboard the vessel is inspected and approved for use aboard the vessel;

13.7.3.2.4 Ensure that all electrical equipment is periodically inspected;

13.7.3.3 Electrical safety is the responsibility of all aboard. All hands and scientific staff shall request permission to bring electrical/electronic equipment aboard.

13.8. Smoking Policy

13.8.1 Purpose

EPA considers occupational health of primary importance in the establishment of its smoking policy, since the Surgeon General has determined that smoking is hazardous to smokers' health, and there is evidence that secondary smoke is harmful to nonsmokers.

13.8.2. Policy

It is EPA policy that smoking shall be prohibited on EPA vessels in all food service and preparation areas, in laboratories, in conference rooms, and in staterooms.

13.9. Accident Reporting Requirements

13.9.1 Applicability

This element is applicable to all EPA vessels, owned or chartered.

13.9.2. Procedures

Any accident on an EPA vessel that results in: (1) Death; (2) An OSHA Reportable Injury or Occupational Illness to any person on-board; (3) Any damage to non-EPA property; or (4) Significant damage to EPA property:

13.9.2.1 Shall be reported immediately to the appropriate EPA Ship Vessel Management Official by the Vessel Master, Chief Scientist or the injured party and confirmed in writing within 48 hours after the accident occurs. Such written reports shall provide full details of the accident, including witnesses' statements.

13.9.2.2 The EPA Vessel Management Official shall immediately notify the local SHEMD Manager. The local SHEMD Manager shall notify Headquarters, SHEMD.

13.9.2.3 SHEMD will determine the need for additional notifications and/or investigations. Based on the circumstances, vessel ownership, who is injured, what is damaged, etc., notification may be required to the USCG and/or DOL. Note: Accidents involving a death or the in-patient hospitalization of three or more employees must be reported to OSHA within 8 hours.

13.9.2.4 In addition, in accordance with U. S. Department of Labor, Occupational Safety and Health Administration requirements, EPA personnel shall complete Form CA-1, "Federal Employee's Notice of Traumatic Injury and Claim for Continuation of Pay/Compensation", following any applicable injury on board. This form shall be filed with the employee's supervisor for appropriate action.

13.10 Vessel Crew Respirators

13.10.1 Applicability

This element is applicable to all EPA vessels where the non-science related work conditions may require the use of a respirator, e.g., painting, welding, etc. The selection and use of respirators for science related exposures is addressed in the Vessel's Chemical Hygiene Plan.

13.10.2 Purpose

Many vessel repair and maintenance operations generate air contaminants which may be dangerous if inhaled. These contaminates can be in the form of gases, dusts, mists, fumes or vapors. Engineering controls are the most effective means for protecting personnel against

such contaminants. However, when engineering controls are not practical or feasible, respirators are necessary to ensure the protection of personnel. Respirators are available in many types and styles and must be matched to the hazard where they will be used for protection. Both the respirator construction material and the filter element composition, for those types that use a filter, must be taken into consideration.

13.10.3 Procedures

13.10.3.1 Selection - Respirators will be selected for a specific shipboard purpose in accordance with Occupational Safety and Health Administration (OSHA) requirements for the use of respirators as contained in 29 CFR 1910.134, Respiratory Protection Standard.

13.10.3.2 Medical Clearance - Vessel Masters are to ensure all crew members required to wear respirators are medically approved to do so.

13.10.3.3 Fit Testing - Qualitative fit testing, by a qualified person, is required prior to any employee's initial use of a tight-fitting respirator and at yearly intervals thereafter. A respirator shall be assigned only to the individual for whom the respirator was fit tested.

Note: Fit testing should not be confused with a fit check which is a test conducted by the wearer to determine if the respirator is properly sealed to the face. A fit check should be performed each time the respirator is donned or adjusted.

13.10.3.4 Cleaning, Inspection and Repair - Each individual who has been fitted for and assigned a respirator is responsible for cleaning and maintaining it in accordance with the manufacturer's instruction manual or pamphlet. The respirator must be inspected prior to and after each use. Any necessary repairs shall be completed in accordance with the manufacturer's instructions. Supervisor's shall conduct periodic checks for serviceability and to make sure respirators are being cleaned and maintained as required.

13.10.3.5 Record Keeping - The Master shall ensure that a record is maintained of the results for each individual fit tested for wearing a tight-fitting respirator. The records shall be retained for a minimum of three years.

13.10.3.6 Problems With Use - If the wearer of a respirator experiences difficulty in breathing, dizziness, senses irritation, can smell or taste the contaminant(s), or the respirator becomes damaged, he/she must discontinue the procedure immediately and seek medical attention.

13.11 Trailering Small Craft

13.11.1 Background

EPA Regions report more operational problems, injuries and property damage from small craft trailering activities than from on-water boat usage. Successful trailering requires four things: (1) A proper trailer in serviceable condition; (2) The correct hitch; (3) A tow vehicle with adequate power, braking and cooling capacity; and (4) A properly loaded trailer with the craft properly secured on it. Additionally, the operator must have the skills to launch and retrieve the boat from the trailer. The following safe trailering data has been adopted from the USCG Safe Boating Course:

13.11.2. The Trailer

13.11.2.1 More damage can be done to a boat by the stresses of road travel than by normal water operation. A boat hull is designed to be supported evenly by water. When transported on a trailer, the boat should be supported structurally as evenly across the hull as possible. This will allow for even distribution of the weight of the hull, engine and equipment. It should be long enough to support the whole length of the hull, but short enough to allow the lower unit of the boat's engine to be extended freely.

13.11.2.2 Rollers and bolsters must be kept in good condition to prevent scratching and gouging of the hull.

13.11.2.3 Tie-downs and lower unit supports must be adjusted properly to prevent the boat from bouncing on the trailer. The bow eye on the boat should be secured with either a rope, chain or turnbuckle in addition to the winch cable. Additional straps may be required across the beam of the boat.

13.11.2.4 The capacity of the trailer should be greater than the combined weight of the boat, motor and equipment.

13.11.2.5 The tow vehicle must be capable of handling the weight of the trailer, (with boat and equipment) as well as the weight of the passengers and equipment which will be carried inside. This may require that the tow vehicle be specially equipped with the following:

(Check your vehicle owners manual for specific information)

13.11.2.5.1 Engine of adequate power;
13.11.2.5.2 Transmission and rear-end designed for towing;
13.11.2.5.3 Larger cooling systems for the engine and transmission;
13.11.2.5.4 Heavy duty brakes; and
13.11.2.5.5 Load bearing hitch attached to the frame, not the bumper.

13.11.3 Pre-Highway Checklist

13.11.3.1 The tow ball and coupler are the same size and bolts with washers are tightly secured. (The vibration of road travel can loosen them.)

13.11.3.2 The coupler is completely over the ball and the latching mechanism is locked down and secured.

13.11.3.3 The trailer is loaded evenly from front to rear as well as side to side.

13.11.3.4 The safety chains are attached, crisscrossing under the coupler, to the frame of the tow vehicle. If the ball were to break, the tongue would be held up by the chains, allowing the trailer to follow in a straight line and prevent the coupler from dragging on the road.

13.11.3.5 The lights on the trailer function properly.

13.11.3.6 Check the brakes.

13.11.3.7 The side view mirrors of towing vehicle are large enough to provide an unobstructed rear view on both sides of the vehicle.

13.11.3.8 Check tires (including spare) and wheel bearings. Improper inflation may cause difficulty in steering. When trailer wheels are immersed in water, (Especially salt water) the bearings should be inspected and greased on a regular basis.

13.11.3.9 Rainwater or water from cleaning, inside the boat, is undesirable for many reasons, but mainly because a collection of it can rapidly increase weight on the trailer, often beyond its capacity. This extra weight may shift with the movement of the trailer and cause a dangerous situation.

13.11.4 Towing Precautions

Pulling a trailer presents problems: More time is required to brake, accelerate, pass, and stop. The turning radius is also much greater; curbs and roadside barriers must be given a wide berth when negotiating corners. It is suggested that prior to operating on the open road,

the vehicle operator practice turning, backing up, and other maneuvers on a level, uncongested parking area. Backing a boat trailer (in particular an empty one) is a challenge even to more experienced drivers and requires considerable practice.

13.11.5 Pre- Launching

13.11.5.1 For the courtesy of others and to prevent rushing, prepare the boat for launching away from the ramp.

13.11.5.2 Check the boat to insure that no damage was caused by the trip.

13.11.5.3 Raise the lower unit of the motor (remove supports) to the proper height for launching so that it will not hit bottom.

13.11.5.4 Make sure the drain plug is in securely !!!

13.11.5.5 Remove tie downs and make sure that the winch is properly attached to the bow eye and locked in position.

13.11.5.6 Disconnect the trailer lights to prevent shorting the electrical system or burning out a bulb.

13.11.5.7 Attach a line to the bow and the stern of the boat so that the boat cannot drift away after launching and can be easily maneuvered to a docking area.

13.11.5.8 Visually inspect the launch ramp for hazards such as a steep drop off, slippery area and sharp objects. (Lessons learned from experience - The size of the portion of the ramp under-water may not be the same as the portion above-water and the ramp may not be as long as you expect!)

13.11.5.9 When everything has been double checked, proceed slowly to the ramp remembering that the boat is just resting on the trailer and attached only at the bow. The ideal situation is to have one person in the boat and one observer at the water's edge to help guide the driver of the tow vehicle.

13.11.6 Launching

13.11.6.1 Keep the rear wheels of the tow vehicle out of the water. This will generally keep the exhaust pipes out of the water. If the exhaust pipes become immersed in the water, the engine may stall.

13.11.6.2 Set the parking brake of the tow vehicle !!!

13.11.6.3 Once in the water, lower the motor (be certain there is sufficient depth as not to damage the prop) and prepare to start the engine (after running blowers and checking for fuel leaks.)

13.11.6.4. Start the boat motor and make sure that water is passing through the engine cooling system.

13.11.6.5 Release the winch and disconnect the winch line from the bow when the boat operator is ready.

13.11.6.6 At this point, the boat can be launched with a light shove or by backing off the trailer under power. Finish loading the boat at a sufficient distance from the ramp so that others may use the launch ramp.

13.11.7 Retrieval

The steps for removing the boat from the water are basically the reverse of those taken to launch it. However, keep in mind that certain conditions may exist during retrieval that did not exist during launching. When approaching the takeout ramp, take special care to note such factors as:

Change in wind direction and/or velocity.

Change in current and/or tide.

Change in water level due to tide.

Increase in boating traffic.

Visibility, etc.

Maneuver the boat carefully to the submerged trailer; stop the engine and raise the lower unit of the engine. Secure engine; then winch the boat onto the trailer and secure it. Finally, drive the trailer with boat aboard carefully from the ramp to a designated parking area for cleanup, reloading, and an equipment safety check. Practice will make launching and retrieving a simple procedure. The best advice is just, "do it cautiously with safety as a main concern." Avoid being rushed by impatient boaters.

SECTION 14 - SHIP OPERATIONS RECORDS AND REPORTS

14.1 Introduction

Other sections of this manual contain additional requirements for records and reports then those listed here. In addition, other records are required that relate to the operation of vessels by licensed officers, trained in these areas. It is not the intent of this section to index all events and subsequent record keeping. This section is intended to highlight those documents and reporting procedures considered pertinent to safety related issues.

14.2 Station Bills

All Class C vessels shall have posted in conspicuous places, Station Bills setting forth the duties of the crew and scientific personnel under emergency situations. New personnel should be indoctrinated in their duties.

14.3 Log Books

A properly kept ship's log is a recognized part of a well-operated vessel. All EPA Class B and C Vessels will maintain a formal log book in which all appropriate records and data is entered. If in doubt, it is much better to log too much than too little. In addition to the purely operational considerations, it is often found that the ship's log is a useful adjunct source of information for the scientific program, and it thus should include sufficient notations of the research operation to permit relating the scientific log books to the ship's operational activities.

14.4 Cruise and Float Plans

Recognizing that planned cruise tracks are often changed between the time a cruise or day trip is planned and submitted, and the time of the voyage:

14.4.1 Cruise Plans

Masters of EPA Class C vessels and Class B vessels over 65 feet in length, shall file a Cruise Plan with their home office, prior to sailing. At a minimum, the plan will contain the following information:

- The names, age, address and phone number of all ship's crew (unless recorded elsewhere).
- The names, age, address and phone number of scientific personnel (including technicians).
- Designation of Master and Chief Scientist.
- Date/Time and place of departure.

- Estimated Date/Time and place of ports of call. Cruise track and operating area(s).
- Capsule summary of science planned.
- Communications instructions to comply with & F.1., below.
- Other information, as appropriate, regarding fuel quantity on board, hazardous material, and explosive and/or radio-active material as may be pertinent to safe and effective vessel operations and rescue.

A copy of the Cruise Plan shall be provided to the EPA Vessel Management Official, and a copy retained on board. The termination of the cruise or a port arrival should be reported, and it is the responsibility of the Master to see that this is done.

14..4.2 Float Plans

Operators of EPA Class A and B vessels under 65 feet in length may, as an alternative to the above, use or modify as desired, the Float Plan form provided at Appendix B-5. Equally acceptable are visual management tools such as a grease pencil/acetate sign out wall board that contains the required information. Regardless of the method used, a system must be in place to track each time an EPA small craft departs and returns from a day's work.

Important Note: The purpose of this requirement is to ensure that supervisors, in particular the supervisors of persons who "check-out" a small craft and trailer it to a body of water to work, (1) Know where the people are; and (2) Know when they are expected back. If they do not return, a knowledgeable search can be initiated after a reasonable period.

14.5 Reporting - All EPA Class Vessels

14.5.1 Daily Reports

EPA marine facilities which operate vessels on frequent cruises should establish and operate a properly licensed base radio station to assure prompt and positive communications, or make positive arrangements to use an existing station. In the absence of a base radio, there should be a routine and positive system of insuring timely receipt and delivery of reports. All vessels while operating should make the following radio (or telephone) reports to their home base or other base designated to receive such reports at least once daily when underway on cruises overnight or longer than one day:

- When any change in the cruise plan affects the planned position or estimated time of arrival (ETA) at any previously designated point.
- When any equipment failure adversely affects the capability of the vessel.

- When adverse weather or other factors affect the planned operations of the vessel.
- On arrival and departure from an overnight or other designated stop.

14.5.2 Loss of Communications

If there is loss of radio or telephone contact, then, as required by the Maritime Safety Act of 1984 (46 CFR 4.04), the EPA designated base facility representative, having reason to believe (because of the lack of daily communications for two successive days, 48 hours, or non-appearance of a vessel, or other unusual instance) that the status of a vessel is uncertain or imperiled, shall notify the cognizant USCG Rescue Coordination Center (RCC). SHEMD will also be notified, through channels. This individual shall continue to use all available means to establish communications with the vessel and determine its status. The person notifying the Coast Guard shall provide complete information concerning the vessel's itinerary, identification, and communication capabilities. The purpose of notification is to make the Coast Guard aware that some uncertainty exists concerning the status of the vessel and to save time if and when it becomes necessary to declare an emergency. A vessel unable to communicate with any station for a period of 60 hours will terminate all operations and proceed to the nearest point where communications can be re-established. Normally, the vessel will proceed to the nearest port having communications capability.

14.6 Oil Transfer Procedures

All EPA Class vessels with a fuel capacity of more then 250 barrels of oil are required to have written oil transfer procedures. These procedures must be available during a courtesy U.S. Coast Guard inspection and must be permanently mounted where the procedures can be easily seen and used by crew members engaged in oil transfers. These procedures must apply to both bulk fuel oil transfers to or from another facility and internal transfers between the vessel's tanks. The requirements for these procedures are contained in 33 CFR 155.720, 33 CFR 155.730 and 33 CFR 155.20,

14.7 Weather Reports

14.7.1 EPA Class B and C vessels while underway should make frequent weather checks. The use of an all-band receiver and a facsimile recorder for weather maps is strongly recommended for those vessels engaged in deep ocean research and extensive Great Lakes missions.

14.7.2 Class A Vessels and Class B Vessels less than 65', should not depart if a

Small Craft Advisory (Winds 18-33 Knots or hazardous waves) is in effect on the body of water, and should return at once if such an advisory is issued while they are underway. To that end, persons operating such craft should receive a weather forecast before operations commence.

14.8 Cruise Handbook

14.8.1 EPA Class C and B vessels should have a cruise handbook or user manual with specific information on the vessel=s capabilities, procedures for planning and conducting cruises. These manuals should be kept current and dated so that users can be sure they have the most current version. EPA Vessel Management Officials, the Master and Chief Scientists should make sure that they thoroughly review and use the appropriate manual when they schedule, prepare for and carry out a cruise.

14.8.2 In addition, the first chapter of the RVOC Safety Training Manual has been published separately as a stand alone safety indoctrination for members of the Scientific Party and new crew members (At Appendix A). The complete UNOLS Safety Training Manual should be made available to regular scientific users, crew members and any other interested persons.

14.9 Security

All reasonable steps must be taken to provide security to EPA vessels and embarked personnel from acts of terrorism, piracy, and other situations which may be encountered on the high seas or in port. In this regard and prior to the beginning of a cruise, the Master of the vessel should become thoroughly acquainted with the nature of the cruise from a security point of view and should share this knowledge with members of the crew. During the cruise, precautions considered necessary and appropriate by the Master should be exercised, including, for example, approaching any vessel or small craft requesting assistance with extreme caution, increasing the deck watch in port, posting additional lookouts in restricted waters, limiting or restricting shore leave, and so forth. The vigilance of all hands on board is necessary to the well being of a cruise from a security point of view.

APPENDIX A

VESSEL SAFETY OVERVIEW

This Appendix was adapted from Chapter 1 of Safety Training Manual prepared by the UNOLS Research Vessel Operators Committee. It was written to provide basic safety information for those crew members and scientists who are serving aboard an EPA vessel for the first time.

This Appendix is written to apply to all research vessels and should be used as a guide to prepare a specific safety overview for each Class B and C EPA vessel.

Note: The crew of the Lake Guardian has prepared such an overview that is based on this document.

INTRODUCTION

EPA research vessels are unique; they may be away from home port for extended periods, operate independently-often in remote areas away from shipping lanes-and travel great distances. For all these reasons, safety should be a personal issue with each crew member and researcher on board.

This document is provided so that you can easily digest many important factors that will soon become part of your everyday life. It lists the more common causes of accidents and provides the basic tenets of accident prevention. It further highlights key areas of seamanship, deck systems, lifesaving and survival procedures, fire prevention and control, health and medical considerations, electrical/electronic systems, basic engineering principles of ship stability and watertight integrity, the identification of hazardous materials, and emergency procedures. This supplement does not profess to make anyone an instant expert. It will, however, enable the novice to become familiar with the safety aspects of shipboard life in a very short time.

Accident Prevention and Safety at Sea - An Overview

SAFETY PHILOSOPHY

The environment and working conditions aboard seagoing vessels pose additional hazards not found ashore. The responsibilities to avoid accidents flow from the top down; from the shore establishment to the Master, to each and every individual aboard. "Safety awareness" by all hands is the biggest single factor in reducing accidents.

As a researcher, you pride yourself in being knowledgeable and proficient in the demands of your discipline. You have undoubtedly acquired patience and a demand for attention to detail when working in the lab to ensure the validity of your research. The demand for such attributes is no less great when learning to live safely aboard a research vessel.

The old cliche "It's not my job" does not apply at sea. Ashore, you can go home and forget about work and the safety-related aspects of your work surroundings. You can easily travel a different route if there is construction work on your normal route. A power failure at home is an inconvenience. You are aware of any medical emergency only by the ambulance sirens. Aboard your ship, not only will you need to be aware of any construction or deck operations, you must be able to determine when and where it is safe to pass. A power failure aboard ship can be catastrophic. A medical emergency aboard ship affects everyone-you may be the only person available to assist the victim.

ACCIDENT-CAUSING FACTORS

Shipboard Environment. As a research party member, you must learn to live and work safely in a potentially dangerous shipboard environment. Such factors as motion, noise, vibration, temperature extremes, close living conditions, rotating machinery, and lines under tension are not normally encountered on shore. Almost all who go to sea will, at one time or another, be seasick. The saying that you first fear that you will die and later fear that you won't is not too far from fact. A seasick person should be given only light duties until recovered and should never be assigned duties that require alertness, caution, or agility. Medicines that prevent motion sickness can sometimes cause drowsiness-beware of this! Ship's motion can cause fatigue in two ways. First, it's sometimes very difficult to sleep when the vessel is pitching and rolling. Even in fairly calm seas, it takes a newcomer one or two nights to adjust. Secondly, just moving about on a vessel in angry seas takes physical effort which in time, will wear down the most fit. Fatigue promotes carelessness.

When temperature extremes are too great, overall performance is impaired. Besides the debilitating effects of sunstroke, heat exhaustion, frostbite, hypothermia, etc., lesser physical impairments are possible. These include increased reaction time, decreased mental awareness, loss of dexterity and coordination, and fatigue.

Noise can have both a physiological and a psychological effect. Permanent hearing loss can be the result of sustained high noise level as well as extreme loud noises of short duration. Confinement aboard a ship in the fog can be unnerving with the constant sound of the fog horn hour after hour and even days on end. Similar detrimental effects can be caused by days of air gun firing. These noises create tension and an atmosphere which may promote an accident. Working around noisy equipment for an extended period of time can cause physical and psychological damage. It is important that you recognize and avoid these potential dangers.

The sun shines brightly at sea, causing glare conditions. Proper eye shading is a necessity. At the other end of the spectrum is night vision. A bright light on a dark bridge or other working area can be blinding. It takes several minutes readjusting your eyes. It is important that you determine the time needed to establish your night vision; it is equally important that you learn to avoid blinding others who have already established their night vision with an unmindful flashlight in the face or any bright white light, to a darkened condition-referred to as establishing night vision. Red lights do not have a blinding effect and must be used when maintaining night vision.

In a shipboard environment-especially confined spaces-you may be exposed to chemical agents in the air. Containing and exhausting laboratory fumes present an additional challenge aboard ships. Recognize these potential hazards! What is acceptable in a shoreside lab may not be suitable in a much more confined shipboard environment.

There are a number of factors which contribute to accidents; few accidents have a single cause. The immediate cause is usually the most apparent, but is not necessarily the underlying cause which may be harder to pinpoint and usually answers the question "why" for any accident. Some of the major factors contributing to accidents on research vessels are:

- Shipboard Environment
- Equipment and Materials
- Training and Experience
- Communications

At sea, slips and falls are the leading causes of injury. Do you know how to properly climb a ladder? Developing "sea legs" is not only gaining experience in navigating wet decks but also knowing what footwear to wear as well as learning to be wary and cautious.

If you do not want to go through life being called "Lefty," learn how to steady yourself without placing your hands on the doorjamb (the knife edge) when traveling through watertight doors.

Equipment and Material. Defective, improperly installed, or improperly used equipment is a major contributing cause of accidents. In doing research from a ship at sea, a lot of faith is placed in machinery and equipment. Whether deploying science packages, working in the labs, or going about your daily routine, you must rely on properly functioning shipboard and scientific equipment. The sudden failure of equipment due to overloading or defective materials almost always leads to an injury. Many pieces of machinery are inherently dangerous and are therefore provided with safety guards, warning signs, and are assigned safe working loads. Ignoring these safety features defeats their purpose.

What are the side effects of some motion sickness medicines? What are the more subtle physical impairments of temperature extremes? Do you know why ships use internal red light at night? Do you know how the basic deck machinery works and where not to be when it is activated? Do you know how or even why you would want to dog a hatch? Learning to find your way around the ship, to understand the terminology, and to recognize factors that have traditionally proven to be causes of accidents takes a little time; take time now!

Training and Experience. A lack of skill, experience, and knowledge concerning shipboard procedures can easily lead to accidents. During your initial exposure to a procedure or a piece of equipment, extra care and supervision may be necessary until everyone is far enough along on the

"learning curve" to make for a safe operation. By paying attention and learning proper procedures, you can eliminate unnecessary accidents.

Communications. People react to what they think they hear, not necessarily what the person speaking actually says. Poor communications due to such factors as language barriers, unfamiliar terminology, background noise, or failure to speak distinctly lead to misunderstanding, mistakes, and ultimately, accidents. The person in charge must establish and maintain good communications in order to coordinate the efforts of a team. Listen so that you clearly understand the hazards you face and their possible consequences. There are no "dumb" questions.

ACCIDENT PREVENTION

An effective accident prevention program is built on the tenets of management and supervisory commitment, safety awareness, and training.

Management and Supervisory Commitment. This includes budgeting time and funds for safety-related activities and equipment; the willingness to reject unsafe practices which might at times, especially under pressure, seem expedient; and positive reaction when risks and/or safer ways to do things are pointed out by crew members.

Shipboard living aboard a research vessel is not a passive exercise - If you are not constantly aware of your surroundings, you can endanger yourself and other crew and scientific members. Although your circumstances as a research party member may not allow you to participate in most shipboard duties, the limited amenities and services of a research vessel require that at the very least you be able to take care of yourself.

Safety Awareness. Safety aspects of every operation should be routinely considered by all hands. Learning to move around your vessel will provide you many new challenges. When climbing vertical ladders, always face the ladder-do not attempt to go backwards. Always hold on to the rail. Avoid using portable ladders unless absolutely necessary-and then, only if it is lashed to an immovable object. When two or more people are using the ladder at the same time, the second person should stay far enough below as not to get kicked in the head, and should not look upward in case of falling dirt or rust. Avoid carrying large objects up or down ladders or stairs; instead, pass or hoist them in assembly-line fashion. Avoid blocking stairwells while stopped in conversation or by placing an object in front of stairs or ladders.

Corridors and passageways should be kept free. While entrance and exit passageways serve as travel routes from one end of the ship to another, they also serve as emergency exit routes. Never block entrance and exit passages with objects. When objects are stored in a passageway, they should not block or be on top of any emergency escape hatch.

Watertight doors normally remain closed, even during calm seas. Watertight doors that are required to be open are done so by latching them in an open position (even in calm seas, be very wary of

watertight doors that "swing" with the ship). During heavy weather, dog all watertight doors. Dog the side opposite the hinge side first.

Ships' crews and researchers must be trained in both emergency procedures and in safe practices. The RVOC Safety Training Manual is to be the basis for such training.

Orientation

INDOCTRINATION

Immediately prior to or immediately after departure, the research party and new crew members, upon hearing the general alarm, gather at a central location with their life jackets. At this time, you will receive an orientation for new people regarding shipboard safety.

The following are normally included in an orientation for new people regarding shipboard safety:

- An explanation of the general alarm signals and where and how personnel should proceed to assigned stations.
- An explanation of station bill and bunk cards.
- How to don life jackets and survival suits.
- What to do in case of man overboard, fire, and other emergencies.
- Requirements for hard hats, shoes, exposure suits, work vests, harnesses, and safety lines.
- When, how, and who to notify for over-the-side research.
- Discussion of other matters of general safety interest.
- Shipboard drills.

STATION BILL

A vessel's Station Bill assigns each person aboard various duties associated with emergencies. It also assigns individuals to muster stations and survival craft. On many research vessels, the Station Bill is specifically for vessel crew members, while a subset of the Station Bill as well as emergency procedure information (also referred to as a Bunk Card) is posted in research party staterooms. Everyone is given an orientation of the vessel and instructions. Part of your orientation is to ensure that you know your assigned stations and duties as listed on the Station Bill, and if applicable, your Bunk Card. Examine these documents carefully; memorize your duties and muster station. You should know two routes for getting out of your living and working spaces in the event of emergency situations; know how to exit these spaces in the dark.

The Station Bill lists the various emergency signals to be used for calling the crew and the research

party members to their stations or to give instructions while at their stations. Your vessel uses standard signals, commonly used in the merchant fleet and required to regulatory agencies. The Master of your vessel may establish additional emergency signals that ensure that all crew members and research party members take positive notice of the emergency.

Fire Stations or Fire Drills

The fire alarm signal is a continuous blast of the whistle for a period of not less than 10 seconds, supplemented by the continuous ringing of the general alarm bells for not less than 10 seconds.

For dismissal from fire stations, there are three short blasts of the whistle and three short rings on the general alarm.

Boat Stations or Boat Drills

The signal for boat stations or drill is a succession of more than six short blasts followed by one long blast of the whistle supplemented by a comparable signal on the general alarm bells.

Where whistle signals are used for handling the lifeboats, they are as follows:

- To lower lifeboats, one short blast.
- To stop lowering the lifeboats, two short blasts.

For dismissal from boat stations, there are three short blasts of the whistle and three short rings on the general alarm.

GENERAL SAFETY PRECAUTIONS

Many injuries and accidents can be avoided by using the proper tools and following safety precautions. The extra ten minutes saved by not following procedures may result in a long-term injury. Most general safety precautions are normally routine practices that we often neglect when we are in a hurry.

Most staterooms and corridors have smoke detectors similar to those used in homes. Learn what to do and where to go when you hear its shrill alarm.

The following are a few examples of common shipboard safety practices:

- When sea conditions are rough and topside work is being performed, everyone works in pairs. You should always wear a work vest.
- Because lines, deck openings, or wet surfaces can cause falls and slips, one eye should always be kept on the deck while walking.
- Bare feet are allowed only in staterooms.

- Examine all labels and warnings before using any equipment or products. If there is a question as to the use of a tool, product, or piece of machinery, consult the proper authority before proceeding.
- Always know the function of anything before touching it.
- Wipe up any spill immediately-the decks are slippery enough!

APPENDIX B

Seamanship/Deck and Science Operations

SMALL BOATS

All personnel embarked in small boats should have a basic knowledge of seamanship. They should be aware of the particular dangers associated with small boats, stability of the boat and safety of all personnel being considered foremost. When you board a small boat prior to removal of the hoisting equipment, you must wear a hard hat. Wear a lifejacket when boarding or debarking. The boat should not be hoisted until all personnel have debarked.

Your conduct aboard a boat should emphasize safety.

Become familiar with basic emergency radio procedures.

Learn the emergency response procedures prior to any voyage.

When transferring from a small boat to the research vessel, time your "jump" to the boarding ladder. Make the jump at the time you are able to reach the highest point on the boarding ladder. Keep your hands inboard to avoid crushing them between the boat and ship's side.

LOADING AND STOWAGE

A ship's officer is responsible for loading, handling, and stowage of cargo and scientific gear; the Chief Mate is responsible for securing deck areas, the Chief Engineer for engineering spaces, and the Chief Steward for commissary, galley, and dining spaces. The Chief Scientist is responsible for securing gear and equipment in science laboratories and storage areas; however, since some researchers may not be experienced mariners, the work is checked by the Chief Mate and the marine technicians prior to getting underway. On research ships, gear is loaded either by hand or cranes. Before heavy lifts are made with shipboard cranes, the Master is informed so that steps can be taken if necessary to ensure adequate stability for the operation. The Master is also consulted for the placement of heavy items such as winches and vans.

Since storm tracks are far from predictable, everyone should be prepared for the worst. The ship should be battened down. Battening down includes securing heavy topside pieces of science equipment with wire or chain; checking all spaces for loose gear; dogging down weather doors, hatches, and vents; and general increasing watertight integrity. Lifelines are rigged, "no-go" areas designated, and a system implemented to account for personnel who must go out on weather decks. You will need to secure gear in your stateroom and work area.

DECK OPERATIONS

Deck Machinery. Deck machinery and deck systems are used to move cargo, handle mooring lines and anchors, and launch and recover scientific apparatus and boats to support the missions of oceanographic research vessels. The inherent hazards of working near tensioned cables, rotating machinery, and heavy moving weights are increased when these operations are conducted on the heaving deck of a vessel at sea. Individuals can be injured by cables or machinery, knocked overboard (possibly unconscious), or injured by flying debris if safety precautions are not followed.

Frames. Extreme care must be exercised when working in the vicinity of frames to ensure that personnel are not knocked overboard or pinned between the frame and other structures when rigging the frame in or out.

General Rigging.

Snapback results from the energy stored in a line as it is stretched. If a tensioned line parts or is released suddenly, the line "snaps back" to its original length-much like an elastic band. You should stay well clear of potential recoil paths of any line or cable in use.

The following safety precautions should be observed during all deck operations:

- Observe all posted safety precautions.
- Keep clear of loaded lines, wires, and cables.
- Avoid getting hands, feet, or loose clothing caught in bights of line, wire, or cables, or in rotating machinery such as moving frames.
- Keep loose gear away from open cargo hatches. Personnel below could be injured by falling objects.
- Keep noise to a minimum-confusion and misunderstanding between operators and workers can lead to serious injury and damage to equipment.
- Do not permit horseplay.
- If you are not a member of the deck operation crew, keep clear of deck operations.

General safety precautions for weight handling equipment:

- Stay clear of moving equipment such as cranes, frames, booms, and davits.
- Wear adequate foot protection.
- Wear hard hats.

General Safety Precautions. In addition to the safety considerations for each individual system, the following general safety precautions should be observed at all times while in the vicinity of operating specialized oceanographic deck systems:

- Keep clear of the wire or cable on deck leading over the side. The weight of the wire or cable, plus the weight of the package, result in high tension which creates a potential personal hazard should the cable part.
- The abrupt movement of the cable or rigging in and out of frames can cause serious injury to unsuspecting personnel.

Leather gloves should be worn when handling wire rope, except when it is moving. Gloves, if snagged, can drag the wearer into danger.

SCIENCE OPERATIONS

Much of research ship time is spent performing science operations, which include towing instruments, working gear over the side or fantail, or placing heavy objects on the seafloor. On a large ship, there may be many independent groups working on different projects at the same time. Nothing goes over the side unless permission from the watch officer is obtained-whether launching scientific gear or disposing garbage.

When scientific gear goes under the ship, it could entangle the ship's rudder or propeller. This can be extremely dangerous when line or cable is going over the side. As it becomes wound up in the propeller, line and the attached equipment may whip off the deck, injuring persons in the process. If during launching or pickup of towed gear, it appears the propeller or rudder may be fouled, the watch officer will immediately stop the screw.

When working over the side, observe proper safety precautions at all times. Wear a safety harness; a lifejacket or work vest must be worn over the safety harness. Double-check all knots. This should be done by another crew member who is fully qualified in marlinespike seamanship. Watch out for the "Might Knot" - the knot that might NOT hold!

Possible towing hazards include:

- Entangling gear in the rudder or screw.
- Engaging gear with other gear off the same vessel, a nearby vessel, or a mooring.
- Becoming "hung-up." When the science gear breaks loose, locked-in potential energy in the towline becomes kinetic energy. People in the path of the towline can be hurt. Stay clear of a towline when it is hung up; nonessential personnel should leave open decks.

Nothing goes over the side without first obtaining permission from the watch officer.

Health and Medical

PERSONAL CARE

Proper diet, rest, hygiene, and attitude are all contributing factors to maintaining a healthy body-both physically and mentally. When you are not in the proper physical or mental state, your actions may adversely affect the well-being of other personnel.

Attitude. When on board a ship, adjust your attitudes to adapt to tight working and living quarters and many different types of personalities. Cigarette smoke is irritating to many people. It is important to be considerate when others are asleep; noise level should be kept down to a minimum at all times.

Due to the close quarters of shipboard living, a clean body and clothing are a must.

Rest. The ability to function properly and to maintain the body's resistance to disease and infections depends on adequate rest. When fatigue sets in, strength, coordination, judgment, and attitude are adversely affected. If you feel fatigue setting in, inform your supervisor; failing to do so could put the ship and crew in jeopardy.

Diet. A proper diet is necessary to maintain the body's energy level. Without proper eating habits, fatigue sets in at a quickened pace and resistance to diseases, colds, and infections is lowered. While at sea, the sun and salt air deplete the body's fluid and salt levels. To compensate for this loss, increase your intake of liquids and salt. If you are on a special diet due to a medical reason (diabetes, high cholesterol, etc.), report this information well in advance of the cruise so that meals and provisions can be properly planned.

Personal Hygiene. Personal hygiene is important. It makes a statement to others about your attitude. An unclean body fosters unpleasant odors and a greater chance of the development of skin ailments and/or diseases, especially in humid and cramped quarters.

Drugs and Alcohol. The use of drugs and/or alcohol does affect the way you perform. Emergencies are usually unannounced and unexpected; a functionally impaired individual would be more of a hindrance than a help. When an individual is drunk or impaired, there is an increased chance of falling overboard, falling off a ladder, slipping on a wet deck, etc. Many prescription and non prescription medicines (antihistamines, cough syrups, etc.) have side effects that can impair judgment and the ability to function properly. If taking medication, you should consult a physician or pharmacist to find a medication that alleviates the problem while causing the least amount of side effects. If you are required by a physician to take prescription medication, notify your supervisor and bring an adequate supply of the medication for the duration of the cruise.

All EPA vessels have a policy of "Zero Tolerance" towards illegal drugs and support Federal

regulations concerning the use of alcohol.

Proper Clothing. Bring appropriate clothing. Sun block and clothing that provide protection against the sun are recommended when traveling to warm climates. Colder climates, naturally, require warmer clothing. Wool and polypropylene materials provide warmth and repel moisture. These materials also retain their insulating properties when wet. In either climate, proper head covering is necessary. Footwear should fit properly. Tired or sore feet can cause considerable problems such as backache and general discomfort. Shoes should have nonslip soles, and steel toes are recommended for deck operations, cargo handling, or other heavy jobs. Foul weather gear should include a jacket, pants, head covering, and proper footwear. Because ship space is limited, the amount of clothing, as well as the type, should be considered when planning a cruise. Bring enough underclothing to last ten days without laundry facilities.

Sandals are not permitted when working on a wet deck, near machinery, or in a laboratory.

SHIP SANITATION

Ship sanitation is critical to the health and attitude of personnel as well as the smooth operation of a ship. The careless disposal of materials not only posses a safety hazard but also detracts from the appearance of the ship. Personnel should clean up work areas; dispose of trash in the proper containers; and wash down the work surface when work is complete. Mops should be rinsed in hot soapy water and left out to dry before stowing-this prevents odors and germs from forming. Liquid spills and/or broken objects should be cleaned up at once. It is imperative to inform the Master immediately if a container of hazardous material breaks or spills. The spillage could cause damage to the ship or injury to the crew. Personnel living spaces serve as home for the duration of the cruise. Shared living quarters must be kept neat as a courtesy to fellow members. Dirty laundry may cause offensive odors and should be put away; bed linen should be changed at least once a week. Toilet/shower facilities must be kept clean and drains unclogged.

MEDICAL

When medical problems occur at sea, more attention is needed than when in port because of the distance from qualified medical personnel. Small problems, left unattended, can become major emergencies.

General Precruise Medical Requirements. All personnel should have a complete physical as required by their institution. A dental exam is also highly recommended. The above may seem like a waste of time and money, but it should be remembered that as the vessel undergoes an overhaul periodically, so should you. All appropriate inoculations (including tetanus) that are necessary for ports of call should be up-to-date. If you need inoculations-whether daily or in an emergency (for diabetes or allergic reactions)-ensure that another person knows how to administer the medication. General medical information should be provided by each person on board. This should include any past or current medical problems (such as diabetes, high blood

pressure, etc.), inoculation record, allergy information, prescription drug usage and dosage, and generic names for prescription drugs. Eye prescriptions should be listed for personnel who wear eyeglasses, and an extra pair of eyeglasses should be carried on board.

If during orientation you somehow missed being introduced to the crew member who acts as the vessel's corpsman (normally one of the Mates), find out now who he or she is and the location of the dispensary.

General Information. The names of personnel who are qualified to administer general first aid, CPR, or emergency medical treatment are posted. At the beginning of the cruise, you will be informed of the location of emergency equipment (eyewash stations, wash-down showers, fresh water, emergency oxygen, etc.), and how to use it.

First Aid Kits. First aid kits are located throughout the vessel and are equipped with basic medical supplies, including Band-Aids, eyewash solutions, ointments, etc.

Seasickness. Medications may be carried on board and dispensed as needed for seasickness. If you get seasick, drink plenty of fluids to prevent dehydration.

Sunburn. Sunburn can be very painful and bothersome and may occur quickly. It only takes about four hours to get second-degree burns in the Tropics. In the case of mild sunburn, moisturizing creams such as Aloe Vera should be applied. The affected area should be covered to avoid further exposure to the sun. Also, drink plenty of fluids to avoid dehydration. Exposure time to direct sun should be increased gradually. Clean the burn area and apply cold water to relieve pain of severe sunburn. The best way you can avoid sunburn is to use a sun block, wear protective clothing, and limit exposure time to direct sunlight.

FIRST AID

Proper administration of first aid can mean the difference between life and death, short-long-term recovery, and permanent or temporary disability. First aid is an interim step until professional medical treatment can be sought. There are two steps that should occur as quickly as possible in a medical emergency: first, ensuring the victim's immediate survival, secondly, summoning assistance. Before going to sea, all personnel should have a basic knowledge of the more serious medical emergencies that can develop and the first steps in treatment.

When approaching an accident victim, survey the area before entering. There may still be danger (i.e., live electrical lines, rotating machinery, hazardous materials, lack of oxygen, etc.)

HYPOTHERMIA

The condition of hypothermia results when body temperature is reduced because of exposure to cold water or air. While at sea, it is important to remember that exposure to cold water causes

heat loss twenty times faster than exposure to cold air. Even a few minutes of exposure under these conditions can cause hypothermia. Hypothermia can even take place in tropical waters. A victim of hypothermia should be treated at once. The first step is to get the victim to a warm area. Secondly, all cold, wet clothing should be removed and the extremities wrapped in blankets.

The torso area should be covered and a hat should be placed on the victim's head. The first area to warm up is the torso, since this area contains all the vital organs of the body. A good way for the rescuer to warm this area is to remove his or her clothing (shirt) and jump around for a few minutes to elevate the body temperature then lie down chest to chest with the victim. This method transfers the heat of one body to another. A warm or hot shower should never be used to warm a victim of hypothermia. The circulatory system to the extremities has been shut down by the body to keep the warm blood near the vital organs. A warm or hot shower would make the body resume full blood circulation throughout the body before the blood in the extremities is warm enough. The shock of the cold blood from the extremities to the vital organs could be more than the body could withstand. Shivering is a good sign because it means the body's natural defense mechanism is working. The body or limbs of a hypothermia victim should not be rubbed due to the possibility of more damage occurring to a circulatory system that is already in severe shock.

Even if a hypothermia victim is not breathing when found, treatment must be initiated at once. It's the body's natural defense mechanism to shut down as much as possible.

Lifesaving Equipment and Survival Procedures

INTRODUCTION

The sea can be a fierce, unforgiving force of nature, capable of sending a ship to the bottom, and its crew "into the drink." Without the proper equipment to protect you from the weather, provide sustenance, signal rescue resources, and, above all, keep you afloat, the odds are heavily against your ability to survive. The only defense you have is the proper amount and type of lifesaving equipment, ready for immediate use. This equipment is vital to survival. Survival at sea depends on sufficient and properly maintained lifesaving equipment coupled with training in survival procedures and the proper use of the equipment.

PRIMARY LIFESAVING EQUIPMENT

Primary Lifesaving Equipment means "a lifeboat or an acceptable substitute." The acceptable substitutes include inflatable life rafts, rescue boats, and, under certain conditions, buoyant apparatus and life floats. However the vessel is equipped, these lifesaving appliances are the first line of defense.

Inflatable Life Rafts. EPA Class C vessels carry a sufficient numbers of life rafts to accommodate 100% of the persons on board. They are mounted as far outboard as possible, free of overhead obstructions, and high enough to be protected from heavy seas. A hydrostatic release and weak link are provided on each container to allow for automatic deployment and inflation of the raft should the vessel sink before the rafts can be deployed. Rafts may be removed from cradles and moved to opposite sides and launched by hand if necessary.

Instruction cards for the proper stowage and launching of inflatable life rafts are posted in various locations throughout the ship.

Buoyant Apparatus. A buoyant apparatus is a flat, box-like flotation device with grab lines installed around its edges; the life float is similar to the buoyant apparatus except it is open in the center and fitted with a net and wooden floor suspended from the center of the float. Buoyant apparatus and life floats are stowed on an open deck or in racks in such a manner to be float-free in case of emergency.

Small Boats. The handling of oceanographic equipment creates a potential risk for falling overboard. Since a ship with equipment over the side is usually unable to maneuver freely for a recovery, the small boat may provide a rapid means of rescuing the victim. It is also ideal for marshaling all the ship's inflatable life rafts or buoyant apparatus in the event the ship has sunk and motor lifeboats are not available.

SECONDARY LIFESAVING EQUIPMENT

While primary lifesaving equipment is provided for the entire crew and is designed for extended survival, Secondary Lifesaving Equipment is provided for individual survival in distress situations. These items will allow a person to remain afloat until rescued.

Lifejackets. All vessels are required to carry one Type 1 Adult Lifejacket for every person on board. A Type 1 jacket is designed to turn a person face up in the water. Additional lifejackets are accessible to the engine room, bridge, and science labs in sufficient numbers to accommodate all persons normally on watch or working in these areas.

Ring Lifebuoys. Ring Lifebuoys are the first means of rescue for the person who falls overboard. Lightweight and round, the ring buoy is easy to toss to the victim and will keep him or her afloat until help can arrive.

Lifejackets are distributed throughout the crew's and scientists' quarters, providing one lifejacket per bunk, and stowed so that they are readily accessible.

All lifejackets are provided with a light, whistle, and reflective tape.

Immersion (Exposure) Suits. Prolonged exposure to the elements of the sea, especially in cold

waters, presents many challenges to an individual's survival, not the least of which is hypothermia-the rapid and continued loss of body heat. Immersion Suits are designed to provide full-body thermal protection similar to a diver's wet suit, as well as built-in flotation, and are required to be on vessels operating in higher latitudes.

Work Vests. Precautions should be taken to avoid unnecessary lifesaving situations. A work vest may be used by persons working on deck or in small boats where the bulk of a regular Type 1 lifejacket would be confining. The work vest is not a substitute for a lifejacket!

When working near or over the water during science operations, a work vest may be the deciding factor in your survival.

Thermal Protective Aids. The Thermal Protective Aid (TPA) is a multi-purpose item of lifesaving equipment. The TPA is a bag or suit made of waterproof material with low thermal conductivity. Its function is to minimize the effects of hypothermia or aid in the recovery of a hypothermia victim. It may be used as an alternative for immersion suits while in a life raft or lifeboat, or a person suffering from hypothermia may be placed inside so that body heat is maintained inside the bag. The TPA does not provide any flotation.

GENERAL LIFESAVING EQUIPMENT AND INFORMATION

Not all casualties at sea result in "taking to lifeboats." Distress situations are more often limited to vessel breakdowns, personnel evacuations, or other instances which require that the vessel be located and assisted by a search and rescue resource. To facilitate the rescue efforts, research vessels carry various devices for location and signaling.

Distress Signals. When a mariner sees a flare displayed in the night sky or unusual smoke rising from the horizon, the first thought is that of a vessel in distress. Not only do these displays indicate a distress, but they mark the location of the vessel. For this reason, distress signals are a necessary part of a ship's lifesaving equipment. All EPA Class C vessels carry at least 12 red rocket flares. They may also carry additional visual signals, such as searchlights, international code flags, and signaling lights.

Line-Throwing Appliance. In situations where a line must be passed over some distance, the line-throwing appliance may save considerable time and effort while providing a greater margin of safety than the conventional heaving line. A line-throwing appliance may be considered when attempting to pass a line to a person overboard. In such cases, only the lightweight, plastic-tipped form of projectile should be employed.

EPIRB. The Emergency Position Indicating Radio Beacon (EPIRB) is a battery-operated, self-activating emergency transmitter. The unit is stowed in a rack, inverted, with the power switch in automatic. When righted, the EPIRB sends out a radio signal to search and rescue resources. An aircraft or vessel can home in on the signal and follow it to a disabled vessel's exact location.

SURVIVAL PROCEDURES

Having to abandon ship is a traumatic experience-gone are the comforts and security of the vessel. Exposed to the elements, either in lifeboats or rafts, or immersed in the water with only a lifejacket, survival at sea in a distress situation depends on an individual's knowledge and training in survival procedures. This is NOT a hopeless situation. Modern technology now makes distress communications and location by rescue resources a routine operation.

General. The Station Bill is where preparations for distress situations begin. It is here that the crew is assigned various duties associated with emergencies (including what equipment to bring, such as an EPIRB) and individuals are assigned to muster stations and survival craft.

Abandon Ship. When the time arrives for the ultimate in survival procedure, having to Abandon Ship, conduct the evolution in a calm, orderly manner-without panic! With adequate preparations and training, there should be no difficulty in carrying out a safe evacuation.

Training. Being properly prepared is the best way to ensure survival at sea. Since it is somewhat impractical to actually sink a ship for practice, the alternative is training. Crew members and research personnel should be thoroughly trained in all aspects of survival techniques from the Station Bill to launching lifeboats. You should participate in the weekly emergency drills as if they were the real thing. Report to stations fully clothed, wear shoes, put on your lifejacket, and bring your immersion suit. In an actual emergency, you may not have time to go back to your quarters.

When the command "Prepare to Abandon Ship" is passed, along with the appropriate emergency signal, the crew instantly begins a planned series of actions similar to the following scenario:

- Muster at your assigned station; provide all equipment to the scene as assigned on the Station Bill; come to your station fully clothed with your lifejacket on and carrying your immersion suit. If there is sufficient time before the actual evolution begins, don your immersion suit first and keep your lifejacket handy. The suit provides flotation and protects you from the elements.
- Prepare all survival craft for immediate launching. Swing out lifeboats or prepare life rafts according to standard procedures. DO NOT LAUNCH any equipment until instructed to do so by the Master. Stand by calmly at your station and await further orders.
- When the Master orders "Abandon Ship," launch all survival craft. Enter boats and rafts using ladders rather than jumping over the side. Keep calm and organized.
- Once boarded, all rafts or boats are tethered and towed away from the ship by a motor lifeboat or the rescue boat. Keep all craft together in the vicinity of the ship's last position.
- While waiting for rescue units to arrive, maintain a continuous visual and radio

communication watch. Your lifeboat or life raft is well-stocked with equipment and provisions to sustain life comfortably. Use the supplies in the survival craft with care-they may have to last a while. Just sit back, relax, and await rescue.

Fire Prevention and Control

INTRODUCTION

Fire prevention should be part of everyday shipboard routine. Because accidents do happen, the ability to control and extinguish a fire quickly is essential to the safety of the vessel and everyone aboard. Persons aboard a research vessel are particularly at risk because their vessel often operates independently in remote areas and is at sea for long, extended periods. Should a fire occur, they must be self-sufficient, since the nearest assistance from shore or another vessel may well be hundreds of miles and several days away. Therefore knowledge, training, and experience with regard to fire safety are imperative to the EPA fleet.

Keep Combustibles and Hazardous Materials Off the Ship. "If it isn't there, it won't burn" - this philosophy applies to materials brought aboard ship as well as those used in its construction.

PREVENTION

There are some basic principles of ship design that can reduce the risk of fire. To prevent fire from spreading, most vessels are divided into zones that usually coincide with subdivision watertight bulkheads. Main vertical zone boundaries consist of insulated steel bulkheads designed to contain fire, smoke, and heat within limits. Spaces in which fire is most likely to occur, such as laboratories, galleys, and machinery spaces, are required to be separated by similar boundaries. Many materials used in the construction of research vessels are noncombustible. Some EPA vessels have permanently installed detection systems that sound an alarm in a normally manned space such as the pilothouse. These devices are similar to smoke alarms found in modern homes. Doors are fitted on all spaces, and ventilation systems are segregated by fire zones to assist in containing any fire. Spaces having greatest fire risk have a fixed extinguishing system. Ships are designed so that two fire hoses will reach any part of the vessel.

Two means of escape are provided from every space that is normally occupied. If one access is blocked by fire, another is always available.

Smoking can be particularly hazardous aboard ship. An improperly disposed cigarette or cigar butt can ignite other materials. Smoking is prohibited in certain areas and under certain conditions, such as while in your bunk, while the ship is refueling, or while in ship spaces such as paint lockers, battery rooms, and laboratories. Cigarette butts must be disposed of safely-preferably by drowning in water, or snubbing out in ashtrays or other proper containers.

Many fires have been started by bunk lights. Light bulbs generate a great deal of heat and under

certain conditions can cause surrounding materials to catch fire. Fires have been started from bedding placed over the top of bunk lights.

CLASSIFICATION OF FIRE

Fires are classified by the National Fire Protection Association (NFPA). Fire classification is used to select the proper type of fire extinguisher. There are four basic fire classifications, lettered A, B, C, and D.

Class A fires are those fueled by combustible solids such as wood, paper, clothing, bedding, and some plastics; any material which leaves an ash. These fires can be extinguished by the use of water.

Class B fires involve flammable or combustible liquids, flammable gases, greases, and similar products. These fires can best be extinguished by smothering agents, such as foam, C02, and dry chemicals. Water spray can also be used.

Class C fires are fueled by energized electrical equipment, conductors, or appliances. To protect personnel from shock, nonconducting extinguishing agents, such as C02, Halon, or dry chemical must be used. Secure electrical power to the circuit causing the problem.

Class D fires involve combustible metals, e.g., sodium, potassium, magnesium, titanium, and aluminum. These fires are extinguished through the use of a heat-absorbing extinguishing agent, such as certain dry powders (different from dry chemicals), that do not react with the burning metals. Specific firefighting agents are used for specific metals.

Knowing the classifications of fire and what type of extinguisher to use on each type of fire is not enough information to fight a fire effectively. You should know where extinguishers are, how to activate them, where to aim the agent, how much to use, how and when to notify others.

FIREFIGHTING EQUIPMENT

Portable Fire Extinguishers. Portable extinguishers are used for a fast attack to knock down flames. However, since they are small, continuous application can be sustained for only a minute or less. Portable extinguishers are classed with one or more letters and with a numeral. The letters correspond to the class/classes of fire on which the extinguisher is effective. A Class A extinguisher should be used on a wood or bedding fire, while a Class C extinguisher should be used on an electrical fire. A Class AB extinguisher should be used on fires involving common combustibles, such as wood, and also on fuel oil, or both. The NFPA rates portable extinguishers with Arabic numerals according to their efficiency. An extinguisher rated 4A extinguishes twice as much Class A fire as a 2A extinguisher, etc. The Coast Guard uses Roman numerals to indicate the sizes of portable extinguishers, with I being the smallest size and V

being the largest size.

Safety Rules for Portable Extinguishers

If you discover a fire, call out the discovery, sound the fire alarm, and summon help. Close door to isolate the fire if it can be done quickly and safely.

- Never pass a fire to get to an extinguisher. A dead-end passageway can trap you.
- If you must enter a room or compartment, don't let the fire get between you and the door.
- If you enter a room or compartment and your attack with a portable extinguisher fails, get out immediately. Close the door to confine the fire and wait for the help you called. Your knowledge will help them.

Water Extinguishers. Water extinguishers use water or a water solution as the extinguishing agent. In general, water extinguishers have application for only Class A fires, except for the foam-type extinguishers which may be used on Class A and B fires. These extinguishers hold 2 1/2 gallons of liquid and discharge their contents in less than a minute. The stored-pressure extinguisher is activated by first pulling the ring pin. The hose is then directed with one hand while the discharge lever is squeezed with the other hand. The stream is aimed at the base of the fire and moved back and forth for complete coverage. Short bursts can be used to conserve water.

Carbon Dioxide Extinguishers. Portable carbon dioxide extinguishers are used primarily for Class B and C fires, with the most common sizes having 5 to 20 pounds of C02. These extinguishers have a range of about 3 to 8 feet and will discharge their contents in 30 seconds or less. A C02 extinguisher is activated by removing the locking pin and squeezing two handles together while holding the hose handle (not the horn) in the other hand. For combating a Class B fire, the horn should be aimed at the base of the fire nearest the operator and then "swept" slowly back and forth across the fire. To combat a Class C fire, the electrical equipment should be de-energized and the horn discharge aimed at the base of the fire. It is important that the hose handle be held and not the horn so that ice or frost that forms on the horn cannot become a current path to the operator if the horn should come in contact with live electrical parts.

Dry Chemical Extinguishers. Dry chemical portable extinguishers, available in several different sizes, use any one of five different dry chemical agents as an extinguishing medium. These extinguishers have at least a BC rating, while some have an ABC rating. Portable cartridge-operated extinguishers range in size from 2 to 30 pounds, while semi-portable models contain up to 50 pounds of extinguishing agent. Units under 10 pound have a discharge duration of 8-10 seconds; the larger units have up to 30 seconds of discharge time. The cartridge-operated extinguisher uses a small

cartridge filled with inert gas mounted on the side of the cylinder to propel the extinguishing agent. The extinguisher is activated by removing the ring pin, and depressing the puncturing pin. These actions release the propellant gas which forces the extinguishing agent up to the nozzle. The discharge should be directed at the seat of the fire, starting at the near edge. The stream should be moved from side to side with rapid motions, to sweep the fire off the fuel. The initial discharge should not be directed onto the burning material at close range (3 to 8 feet), as the stream of extinguishing agent may scatter the fire or spray burning liquid about. The agent may be applied in short bursts by opening and closing the nozzle with the squeeze grips.

When activating a cartridge-operated dry chemical extinguisher, aim the top of the cylinder away from you. If the top has not been screwed on properly, it may come off violently and cause injury when the propellant gas charges the cylinder. Also, test the extinguisher before taking it into a fire by giving the hose nozzle a quick squeeze-then you know whether it will work or not.

Halon Extinguishers. Halon portable fire extinguishers come in two types, Halon 1211 and Halon 1301, and several sizes from 1 to 20 pounds. They are rated for Class B and C fires. Some Halon 1211 extinguishers are also rated for use on Class A fires. The discharge range from these extinguishers is from 4 to 15 feet and they are discharged quickly. Halon 1211 is not affected by the wind as much as C02 or Halon 1301 and on a weight-of-agent basis is at least twice as effective as C02. Persons should avoid breathing the extinguishing agent or the gases produced by the thermal decomposition. Halon 1301 is at least as effective as C02 on a weight-of-agent basis, is suitable for cold weather operation, and leaves no residue. On Class B fires, Halon from portable extinguishers is applied in the same manner as C02.

Semi-portable Fire Extinguishers. A semi-portable fire extinguisher (or extinguishing system) is one from which a hose can be run out to the fire. The two types of semi-portable systems are: C02 hose-reel and dry chemical hose systems. Semi-portable fire extinguishers provide a means of getting a sizable amount of extinguishing agent to a fire rapidly. These systems have greater capacity and have slightly more range (nozzle to fire distance) than hand-portable extinguishers. As the name implies, they are only and fires may be fought only within the range allowed by the discharge hose. They cannot be carried about the ship like hand-portable extinguishers.

Fixed Fire Extinguishing Systems. Fixed fire extinguishing systems are usually built into the ship at the time of its construction. These systems are carefully designed: they consider the fire risks aboard the vessel, must meet exacting regulatory standards, and are available for use in an emergency. If a large fire develops, such as one in a machinery space, these systems may be the best means to extinguish it. There are four types of fixed systems common to research vessels: the fire main system, carbon dioxide system, Halon 1301 system, and the galley range system.

COMBATING THE FIRE

When a fire is noticed, the first thing to do is sound an alarm. The pilothouse must be notified of the location, and if known, the type of fire. This is important no matter how small the fire. It can

be done by intercom, sound-powered phone, going to or sending someone else to the pilothouse, or by yelling.

Don't be a hero and try to fight a fire without sounding an alarm first. A fire can quickly get out of control and you could be trapped or overcome.

If the fire is small, the previous information is designed to help you choose the right extinguisher and put it out. If the fire is larger or gets out of control, then the training, coordination, efficient use of manpower, and a more thorough assessment of the situation that comes with the crew's damage control team will be necessary.

If you do fight the fire, remember the word: PASS

PULL the pin.....Some extinguishers require releasing a lock latch, pressing a puncture lever, or other motion.

AIM low.....pointing the extinguisher nozzle (or its horn or hose) at the base of the fire.

SQUEEZE the handle.....This releases the extinguishing agent.

SWEEP from side to side.....at the base of the fire until it appears to be out. Watch the fire area. If fire breaks out again, repeat use of the extinguisher.

Most portable extinguishers work according to these directions, but some do not. Read and follow the directions on your extinguisher-on each one if you have more than one make or model.

Protect yourself at all times! Stay low. Avoid breathing the heated smoke and fumes or the extinguishing agent.

If the fire starts to spread or threatens your escape route, get out immediately.

If your first indication of a possible fire is the sight or smell of smoke coming from a closed compartment, you must be careful before opening that space. Feel the door or hatch for heat (cautiously, with the back of your hand). If it is hot or warm, do not open it. Notify the pilothouse or firefighting party immediately.

Stability and Watertight Integrity

STABILITY

Stability of a ship depends on the hull form chosen by the designer and how the weights, such as fuel, stores, provisions, scientific equipment, etc., are distributed about the ship. Vessel operators have little control over the vessel's form. They do, however, have great control over

how much weight is taken aboard, how and where that weight is stowed, and the consequent effects on vessel stability.

As a research party member, you have the responsibility of making known to the crew the nature and amount of weights you have brought on board, and strictly abide by the Master's instructions regarding weight stowage and locations, particularly liquid weights and weights stowed high in the ship. Because all stability assessments assume a watertight shell and weather deck, everyone must keep watertight fittings closed at all times. Report any damaged or inoperative fittings to the Master.

Water on deck increases the probability of downflooding through any opening. Freeing ports are fitted in bulwarks to allow water from boarding seas to drain overboard quickly. Ensure that freeing ports are unobstructed. Do not block freeing ports!

The act of lifting or hanging any weight from the vessel's crane, boom, A-frame, J-frame, etc., raises the vessel's center of gravity. As soon as the weight is lifted clear of the deck, the downward force of the weight acts at a point at the top of the weight handling equipment. If a crane is hoisting a weight over the side, the center of gravity is also shifted off center, introducing a list. When planning heavy lifts or over-the-side science operations, consult with the Master to ensure that effects of the ship's stability from such operations are within acceptable limits.

Science operations, such as towing instruments, working gear over the side or fantail, or placing heavy objects on the seafloor, can influence stability in several ways:

- The vessel may be constrained from assuming the course and speed most favorable to stability and may be subjected to icing, boarding seas, beam winds, etc.
- Working heavy weights over the side reduces stability.
- The tension of the towline or gear line may introduce a heeling moment similar to that of a beam wind.

WATERTIGHT INTEGRITY

A ship's form and subdivision are calculated to provide adequate stability and resistance to damage at her design draft. These design features are defeated if the skin of the ship and subdivision bulkheads are not watertight. The original watertight integrity of a vessel is determined by its design and the quality of its construction. The proper maintenance of that integrity is a vital part of any ship's preparations to resist damage. Each undamaged tank or compartment aboard ship must be kept watertight if flooding is to be controlled and not become progressive after damage.

Know the importance of watertight fittings-strive to keep them closed when not in use. It is equally important to keep freeing ports clear. Report inoperative, damaged, or leaking fittings to

the Master.

Electrical Systems/Equipment

INTRODUCTION

Individuals who work with shipboard electrical equipment must be particularly vigilant about safety, as injuries from electric shock and short circuits are too often fatal. A shipboard environment is particularly dangerous with regard to electrical systems. Because decks are made of steel and form a direct electrical path to sea water, a person touching live electrical parts would normally become a part of this circuit. The body's resistance to current flow falls with an increase in moisture level in the skin. For example, a perspiring individual working in a hot machinery space coming in contact with live electrical components would have minimal resistance to current flow and would receive much more current than a person with dry skin. This adds to the hazards of working around machinery.

Because short circuits are usually accompanied by arcs and sparking, there is always the possibility of a resulting fire. When working with electrical installations, be attentive to the risks of fire.

A 100 milliampere current can be fatal - this is about 1/1,000 of the current regularly flowing through a household light bulb. Ventricular fibrillation-the uncoordinated actions of the walls of the heart's ventricles-occurs when current flowing through the body approaches 100 milliamperes, which in turn causes the heart to stop pumping. Ventricular fibrillation will usually continue until some force is used to restore the heart's movements to a coordinated pumping action. Current flow of 200 milliamperes or higher through the body will cause severe burns and unconsciousness. It will also cause a clamping action of the heart muscles which prevents the heart from going into ventricular fibrillation. If breathing can be restored immediately, victims will often recover from these injuries.

UNGROUNDED ELECTRICAL SYSTEM

Most shipboard electrical distribution systems are not grounded, and in that respect are different from household or shore systems. Neither of the two conductors in a shipboard system is grounded, while the potential between them is about 120 volts. If an individual, while grounded, were to touch either of these two conductors, that person would receive a severe shock. All live electrical circuits are always treated as potential hazards.

PERSONAL SCIENTIFIC EQUIPMENT

Electrical equipment brought aboard for personal use, such as music systems, hair dryers, etc., should be examined by the Chief Engineer. This examination determines whether they are wired with one conductor connected to the chassis, as is common with some electronic equipment. If such equipment is used aboard a ship, it provides a hazardous path to ground for the electrical distribution system and must be rewired to the satisfaction of the Chief Engineer.

Scientific equipment (including power supplies and clean power sources) and the metal racks usually erected for stowage of scientific equipment should be properly grounded. Any discrepancies found should be reported to the Chief Engineer and remedied before such equipment is energized. Temporary electrical cables rigged for scientific equipment should be arranged to the satisfaction of the Chief Engineer. This includes marking the cable for identification and ensuring the cable is properly supported, free from possibility of chaffing, is properly protected by an overcurrent device, and is of proper size and construction for the application. Further, such cables should be removed after they have served their purpose.

ELECTRICAL SAFETY PRACTICES

- Consider the results of each act. There is absolutely no reason for individuals to take chances that will endanger their lives or the lives of others.
- Assume circuits are live. Don't take the word of others. Stored capacitance can be fatal. Take time to test/discharge circuits before starting work.
- Test your tester. When testing circuits to see if they are live, test a known voltage source first to see if your tester works.
- Heed warning signs. If a sign warns that there may be two sources of power to a cabinet, take time to identify and secure both sources before reaching into the cabinet.
- Use your senses. Be alert to smoke, overheating, and an "electrical smell" which are signs that trouble may not be far off
- Authorized personnel only. Only personnel authorized by the Chief Engineer should work on installed shipboard electrical equipment. Researchers should coordinate their requirements with the Chief Engineer before proceeding with work which may impact a ship's distribution system.
- Keep covers closed. Close covers to fuse panels, junction boxes, etc., when not in use. Covers are there to keep moisture and debris out.
- Count tools. When working in cabinets or other equipment, count the tools you take in with you and be certain that you remove the same number when you leave.
- Beware of dual voltages. Some switchboard panels have both 450-volt and 120-volt circuits. If servicing a 120-volt circuit, beware that a higher voltage circuit is close by.
- Remove jewelry. Don't wear jewelry when working with electrical equipment or moving machinery. Remove rings, necklaces, and bracelets when you need to work near live components. The jewelry may serve as a path to ground or cause a short circuit which could be fatal or cause injury. The same applies to metal zippers on

clothing.

- Tagged-out equipment. The ship's electricians and engineers place equipment out-of-service if it could jeopardize safety of personnel or cause equipment damage if started. Know how to secure all sources of possible power to such equipment.
- Leave equipment in working order, or tag it out-of-service before you leave.
- Do not service high-voltage equipment alone.
- Do not ground yourself. Make sure you are not grounded when adjusting equipment or using measuring equipment. Use only one hand when servicing energized equipment. Keep the other hand behind you or in your pocket.
- Don't energize wet equipment.
- Use only properly grounded power tools.
- Use fuse puller when pulling fuses.
- Examine extension cords and portable cords.

Engineering Safety and Practices

INTRODUCTION

Danger to personnel exists to some degree in every shipboard engineering operation. Because that danger is a constant companion, you may tend to discount the disastrous possibilities and ignore measures necessary to prevent accidents. Hazards to personal safety exist in virtually every system in the engineering department. High pressures and temperatures, volatile fluids, and rotating machinery which may start without notice are waiting for the unsuspecting crew member to make a mistake.

Gasoline presents a far greater hazard than diesel fuel. It must only be stored and transferred topside on weather decks. Exercise great care when fueling.

FUELING SMALL BOATS AND ENGINES

Fueling procedures for small boats and small engines depend on specific equipment. Fuel may be transferred from ship's tanks or drums to the boat tank by hose (diesel boats), gasoline cans may be simply placed in a boat and connected to the engine by hose (outboard-motor-driven boats), or gasoline or a gas/oil mixture may be poured from storage cans to a built-in fuel tank (portable pumps, chain saws). Whatever the method, take precautions to avoid spills, fires, or injuries. When using a transfer hose from the ship's tanks, ensure proper alignment of valves, adequate communications, and pre-established emergency procedures.

For drum or can transfers, provide drip pans under the transfer points and be cautious of overflows. When refueling portable equipment, use good judgment to prevent spills on deck or on the equipment. Never refill a tank over a hot engine. A small amount of gasoline spilled on the engine may flash and ignite the whole can with disastrous results. Contain and clean up any

spills immediately.

Become familiar with the following precepts of safety:

- Report unsafe conditions. Notify your supervisor or a ship's officer if you feel a condition, equipment, or material is unsafe.
- Warn others. Take the time to remind shipmates of safety precautions.
- Use protective equipment. Ear and eye protection, protective clothing, and breathing equipment are provided for your safety-use them.
- Use safety guards. Safety guards and devices are placed on tools and equipment to prevent injury-use them correctly. If you find a safety guard missing or misaligned, inform the Chief Engineer.
- Report injury or ill health. Report any injuries or evidence of impaired health to your supervisor or a ship's officer.
- Exercise caution. Be alert to the hazards of the work place and take all necessary precautions.

REPAIRS

Machinery and equipment must be maintained and repaired properly. When making repairs, do it right the first time! Make-shift repairs could injure an unsuspecting person who doesn't know that the machine has been jury-rigged.

Hazardous Materials

INTRODUCTION

Research and shipboard personnel can expect to encounter hazardous materials in the form of ship's stores, paints, laboratory chemicals, cleaning agents, etc. Therefore, a working knowledge of these materials and their hazards will assist personnel in handling and storing them in a safe, responsible manner.

You are assumed to have experience and a good working knowledge of procedures for handling, storing, and disposing of hazardous materials within a shore-based laboratory. It is anticipated that you will continue your reading of the RVOC Safety Training Manual-especially Chapter 13, "Hazardous Materials," as well as resource documents that are listed therein.

Hazardous material is any substance which, because of its chemical properties, can cause the deterioration of other materials or injury to living organisms. Hazardous materials are grouped into five major classes:

- Flammable or explosive
- Corrosive

- Reactive
- Toxic or poisonous
- Cryogenic

PROTECTION

In order for hazardous materials or chemicals to harm the body, they must first gain entrance. Methods of prevention include removal or confinement of hazards, use of protective equipment, or a combination thereof

Procedures for handling hazardous material aboard a research vessel may be different than what you are used to. Plan your experiments with minimal waste-you are limited to the storage aboard for disposal; you just don't heave HAZMAT overboard! Containers are prone to spill when the deck is moving. While at sea, some of your procedures that used to be "automatic" will have to be altered to accommodate the new environment.

Hazard Removal. The best way to protect yourself from hazardous materials is to eliminate the possibility of contact. Hazard removal may be accomplished by physically removing the hazardous substance or rendering it harmless. Potential hazards can be removed or reduced by limiting the types and quantities of hazardous materials stowed and used on board and properly disposing of hazardous waste.

When presented with a spill or other hazardous situation, try to:

- Limit the spread of the hazardous material to the smallest area possible with physical barriers.
- Limit access of personnel to the hazard area and vicinity.
- Shut down or plug up the source of the hazardous material.
- Neutralize the HAZMAT with other chemicals.

Hazard Containment. Hazardous materials that are carried must be properly packaged and stored to prevent injury. Storage and use areas are designed to contain or limit the spread of any spilled materials.

Personal Protective Devices. Personal protective devices are worn when working with any known or unknown hazard. The skin and the respiratory tract provide only limited natural protection against harmful substances. Personal protective equipment provides a barrier between the person and the environment to prevent harmful effects from hazardous chemicals.

LABORATORY CHEMICALS

Various forms, types, mixtures, and quantities of chemicals will be found in a laboratory. The most important factor of the use of laboratory chemicals on board a research vessel is safety. Due to the

mixture of chemicals in a laboratory, there are increased hazards in these areas. There are chemicals that react with each other, water, metals, and other common items. The storage and handling of laboratory chemicals must be done carefully and by trained personnel.

When working in the lab, wear proper clothing: goggles, lab coat or coveralls, and gloves when necessary. Know the location and how to use the protective equipment on board: ventilation hoods, eye wash stations, fresh water, personal showers, and disposal units. All chemicals in the lab must be properly marked and stored in proper containers. Acids, which are highly corrosive, cannot be stored in metal containers. Any chemicals brought on board in large quantities should be stored in the appropriate lockers until they are needed. Chemicals that react with each other must not be stored in the same place; acids should not be stored with alkalis.

Any chemicals used or created on board and ready for disposal should be placed in a clearly labeled disposal unit and properly stored until port is reached. Dispose of chemicals in accordance with applicable regulatory requirements.

If a spill occurs in the lab, the personnel cleaning the spill should know what was spilled and what substances react with the spilled chemicals before cleaning. There are chemicals that will react violently with water and should be cleaned up with dry cloths. If personnel are splattered with a chemical, the affected areas should be washed with lots and water and medical attention sought.

Personal Protection

- Eye protection against irritating fumes or corrosive liquid chemicals should consist of face mask or goggles.
- Spaces that have been closed for significant periods of time should not be entered without respiratory protection until it has been established that a safe atmosphere exists.
- Full face shields, rubber gloves, rubber boots, and aprons should be worn when handling corrosive materials.
- Lab coats and goggles should be worn in the laboratories when necessary.
- Exposure to particulate matter requires the use of a respirator with an appropriate filter for protection against dust, fumes, mists, fogs, liquids, and solids.
- Protective skin cream or gloves or both should be used by handlers of sensitizers or potential skin irritants such as epoxy and polyester resins and hardeners.

REACTIVITY

Many chemicals that are nonhazardous in a natural state, or have a low to medium degree of hazard, can become highly hazardous when placed in contact with another chemical. The resultant mixture can be more reactive, produce more hazards, and be several times more toxic than each chemical by itself. In some cases, chemicals may react violently, even explosively, when brought together. Spontaneous explosion or heat sufficient to ignite nearby combustibles may result. Electrical currents

or arcs or extreme heat can liberate or cause the formation of hazardous compounds, or the decomposition of harmless substances into hazardous materials. For example, nitrogen dioxide (N02) is formed by welding arcs; electrolysis in sea water releases chlorine and hydrogen gas and may produce other compounds. Oxygen in a gaseous state increases the flammable potential of other materials around it; as a liquid, it has the ability to freeze living tissue to the point of shattering. Water, when added to certain burning metals, increases the intensity of the fire; moisture in the air or perspiration can cause some chemicals to ignite spontaneously.

COMPRESSED GASES

Compressed gases such as oxygen, helium, nitrogen, and other inert gases, are used on board for many different reasons. They can be used for medical purposes, cutting and welding, weather balloons, and for laboratory experiments. Cylinders should always be kept secure. If a cylinder ruptures it could cause an explosion, feed a fire, or become a missile hazard.

Basic safety precautions for handling compressed gases:

THE ALWAYS LIST	THE NEVER LIST
Always open cylinder valves slowly to allow a graduate pressure buildup and to prevent diesel effect in the line or regulator.	Never use a cylinder or its contents for other than its intended use, and NEVER use a cylinder (not even an empty one) as a roller or support.
Always keep cylinders away from hotwork (welding/cutting) areas so that sparks, slag, or flames will not reach them.	Never use valve protection caps for lifting cylinders.
	Never use a magnet for lifting.
Always store cylinders, both full and empty, so they won't be knocked over.	Never use slings for lifting. Use a cradle.
Always keep valve protection caps in place and hand tight, except when in use or connected for use.	Never use a hammer or wrench to open cylinder valves.
Always clear the cylinder valve connections of any dirt particles by briefly opening and closing the valves before connecting regulators. Do not stand in direct line of a cylinder valve when opening it.	Never drop or allow any cylinder to fall, especially one that contains oxygen.
	Never tamper with safety plugs (safety relief valves)
	Never connect a regulator to a cylinder

Always purge manifolds in a similar manner before connecting regulators. To lessen the chance of rupturing the diaphragm, always ensure the regulator adjusting screw is backed out all the way before opening bottle valve.

Always remove faulty regulators from service.

containing a gas other than that for which the regulator was designed.

Never pressurize cylinder, tank, or compressed gas system higher than its rated pressure.

PAINTS AND SOLVENTS

Aboard a ship, one can find a supply of paints, strippers, thinners, and cleaners (turpentine), all of which have a hazard potential. Many of the paints and solvents have low flash points, which increases the risk of fire. Paints and solvents produce toxic fumes when they are applied, drying, or removed. Wear respiratory protection and appropriate clothing (long-sleeve shirt, long pants, etc.) when painting.

Maintain proper ventilation (either natural or forced with a fan), do not smoke, and avoid using electrical equipment when applying paint and during drying and curing. Personnel handling the substance should wear respiratory mask whenever there is a risk of inhaling toxic fumes.

RADIOACTIVE MATERIAL

Most science work using radioactive isotopes involves very low levels of radioactivity. Normally, even prolonged exposure would have no harmful effect on an individual. While spills could cause contamination or "dirty" a lab or van, these terms refer only to the negative effect on minute scientific measurements.

Radioactive materials are defined as any material or combination of materials that spontaneously emit alpha or beta rays (sometimes gamma rays) by the disintegration of the nuclei of atoms. Containers with radioactive materials must be labeled with the proper symbol for radioactive.

Keep radioactive material in one area, preferably a separate van. The working surfaces should be made of a nonporous material that is resistant to sea water and radioactive materials. Any materials that have the ability to become airborne should be worked on only in an approved fume hood.

All radioactive material should be stored in one locker clearly marked "RADIOACTIVE". Radioactive materials are kept in their original containers until they are used. Solid waste materials may be stored in cans that are properly labeled and sealed. Liquid radioactive waste may be stored in plastic jars or bottles. The locker should be protected from the weather and unauthorized removal of contents. In any area where radioactive materials are being processed or handled, film badges or other exposure-measuring devices could be required and the area clearly marked "RADIOACTIVE

MATERIALS IN USE." While working with isotopes, wear lab coats and gloves. Protective clothing should not leave the lab until declared radiation free. Eating, drinking, or smoking must not be permitted in areas where radioactive materials are being handled or stored. Food and beverages should never be stored near radiological laboratories or in the same refrigeration units as radioisotopes. All radioactive waste materials and any materials suspected of being contaminated should be placed in properly labeled waste containers.

In the event of a spill of radioactive material, the following general procedures should be followed:

- Keep all personnel who were in the area of the spill together until they can be tested for contamination levels. Seek qualified medical help as soon as possible.
- Block off the area where the spill occurred.
- If the clothing of personnel has been contaminated, remove and dispose of properly.
- Keep all unaffected personnel away from area until uncontaminated personnel in full protective clothing arrive to clean up the area.

MARINE SANITATION DEVICES

Marine sanitation devices (MSD) installed on board ships are used to hold or treat raw sewage and waste water. While these systems perform well in abating water pollution, the tanks and the chemical processes present hazards to personnel required to operate and maintain them.

The primary hazard to personnel from marine sanitation systems is hydrogen sulfide (H2S) gas. This gas is invisible and has a characteristic odor of rotten eggs. It is highly toxic and flammable. Although the odor is detectable at low levels (less than 1 ppm), prolong exposure to moderate levels (30-50 ppm) or brief exposure high levels (more than 100 ppm) can cause olfactory fatigue, or loss of the sense of smell. Therefore the presence of H2S cannot always be reliably detected by its odor. At extremely high levels (500 ppm or greater), H2S acts as a systemic poison, causing unconsciousness or death due to respiratory arrest. In addition to H2S other hazards associated with marine sanitation spills are the release of methane and other hydrocarbons, release of ammonia, reduction of oxygen in the space, and elevated levels of carbon dioxide in the air. Transfer of communicable diseases is also of great concern.

If a marine sanitation leak or spill occurs, or if the odor of H2S is detected, leave the space immediately. You may return to the area only when the space is certified to be safe.

SOURCES OF INFORMATION

Hazardous Substance Identification Systems. Because of the need for identification of hazardous material, two systems (NFPA 704M and DOT) for hazardous substance identification have been developed.

NFPA 794M Hazardous Identification System The NFPA 704M System is a standardized marking

system which uses numbers and colors on a sign to define the three basic hazards (health, flammability, and reactivity) of a specific material. The ratings for individual chemicals can be found in the NFPA Guide to Hazardous Materials. Other references are the US. Coast Guard (USCG) Manual; CHRIS, Volume II; and the National Safety Council's Fundamentals of Industrial Hygiene.

DOT Hazard Identification System The DOT Hazardous Materials Transportation Administration regulates over 1,400 hazardous materials. DOT placards and labels indicate the nature of the hazard presented by the material.

Summary

Living and working abroad an EPA vessel can be safe for those who know and practice safety. Emergencies must be reported and handled properly. Are you ready for this cruise? Safety is the responsibility of every person aboard - you. In the laboratory, you have learned to control the environment to ensure consistent results of your experiments. Although you cannot totally control the shipboard environment, you can control your actions and be prepared. Have a safe and successful cruise!

APPENDIX C - DIVE OPERATIONS

NOAA FORM 64-3
U.S. DEPARTMENT OF COMMERCE(6-74)
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

DIVE SAFE SHIP OPERATIONS
(See reverse for checklist)

THE FOLLOWING MESSAGES ARE TO BE TRANSMITTED OVER THE ADDRESS SYSTEM:

_____

_____ PRIOR TO COMMENCEMENT AND EVERY 30 MINUTES THEREAFTER THROUGH COMPLETION: "There are divers working over the side. **DO NOT** operate any equipment over the side, rotate screws, cycle rudder, take suction from or discharge to sea, blow or vent any tanks, activate sonar or underwater electrical equipment, open or close any valves or cycle trash disposal unit before checking with the Dive Master _____(name).

_____

_____ AFTER COMPLETION: "Diving operations are now complete. Normal and routine work may be carried on in accordance with previous instructions.

NOTE: No particular sequence is required in signing diving form. Upon completion of all notifications and actions, the Dive Master will indicate his belief that safe operations can commence by signing at the bottom of the checklist on the reverse. In the event that there is a delay in the commencement of diving operations, each person whose signature appears on the checklist will be informed.

DIVING OPERATIONS

DATE OF OPERATION	COMMENCEMENT TIME	COMPLETION TIME

NAME OF SHIP
NATURE OF DIVING OPERATIONS:
_____ _____ _____ _____ _____ _____

NOAA FORM 64-3 (6-74)

NOAA FORM 64-3

U.S. DEPARTMENT OF COMMERCE(6-74)

NATIONAL OCEANIC AND ATMOSPERIC ADMINISTRATION

DIVE SAFE SHIP OPERATIONS - CHECKLIST

Please Note: Signing of this checklist will indicate that the individual has been advised of the diving operation and that he has completed the required actions to insure that "SAFETY" of the divers will not be jeopardized.Personnel indicated below shall sign form prior to commencement and upon completion of diving operations.Diving operations will not commence until all required signatures are received and this form is returned to the Dive Master.

PERSONNEL	PRIOR TO DIVE	TIME	AFTER COMPLETION	TIME
REPAIR ACTIVITY:				
Repair Authority				
CO				
XO				
ODD				
SHIPS ALONGSIDE:				
OOD				
OOD				
OOD				
OOD				
SHIP BEING WORKED ON:				
Engineering Officer				

Boatswain				

SECURE: (appropriate authority initials)				
Rudder				
Trash Disposal Unit				
Tank Blows				
Tank Vents				
Shaft Locked				
Sea Suctions				
Sea Discharges				
U/W Electrial Equipment				
Other U/W Equipment NotListed				
Appropriate DivingSignal Displayed				
Appropriate DivingSignal Removed				
REMARKS				
DIVE MASTER	OOD			

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ENVIRONMENTAL PROTECTION AGENCY

SHIP PETER W. ANDERSON

SAFETY PLAN FOR SMALL BOAT DIVE OPERATIONS

1997

INTRODUCTION

This plan establishes general guidelines and procedures for the safe and efficient use of small boats supporting dive operations. For the purposes of this plan, small boats are defined as U.S. Coast Guard Class A or Class 1 vessels (i.e., boats less than 26 ft. in length). Depending on the type and size of boat being used, the area of operation covered may include coastal waters out to 5 miles offshore and all interior waters.

BOAT OPERATIONS:

1. Boat operators shall check the boat to be used, to ensure the boat is seaworthy and in safe operating condition;

2. All personnel involved with dive operations should be familiar with operating the boat including navigation and communications equipment;

3. The boat should always be positioned to provide immediate assistance to the divers in the water, including protecting them from other water craft;

4. If the boat is anchored on station, it must be moored in such a way as to be able to slip moorage immediately, e.g., with a buoyed anchor line;

5. During adverse sea or weather conditions, the boat <u>should not be anchored</u> if there are divers in the water, except if there is an engine failure;

6. If the dive tender loses visual contact with the dive team bubbles, the boat operator will remain in the immediate area where the divers were last observed

and ensure the divers on the bottom are immediately notified via the diver recall unit that their location has been lost. (The divers do not need to immediately surface, only to be extremely careful on ascent.);

7. If unsafe sea or weather conditions develop, dive operations may be canceled or suspended by the Dive Master in charge.

BOAT EQUIPMENT:

In addition to the equipment on the checklist specific for each boat, the boat operator will ensure the following equipment is onboard:

1. Emergency equipment: Emergency oxygen kit, including a field first aid kit;

2. A compass, VHF radio, navigation lights, fog horn (hand held is OK);

3. The VHF radio shall have working frequencies for monitoring commercial vessel traffic, bridge to bridge communication, inter-ship communication, and distress calls;

4. Anchor or anchors with lines suitable for holding the vessel in the range of bottom types and water depths where the boat will operate;

5. Appropriate dive flags (red & white diver down flag, and a blue & white code flag alpha);

6. Drinking water;

7. A diver recall unit with both tone signals and a microphone for direct verbal communication with the divers, shall be available to rapidly recall the divers if diving is greater than 100 yards from Anderson;

8. A divers ladder for ease of boarding, if the boat cannot be easily and safely entered from the water by divers; and

9. Basic tools for working on the engine and boat.

RESPONSIBILITIES OF BOAT OPERATOR:

Boat Operator is responsible for the vessel and all personnel on board, and shall:

1. Review the dive plan with the Dive Master;

2. Brief the boat crew, including the dive team, on the location of the medical oxygen kit, first aid equipment, fire extinguishers, and, if necessary, operation of the navigation and communication equipment.

A diver may be the boat operator, but must not be the designated dive tender.

Dive Team Members should assist the boat operator during launching, mooring, anchoring, or at any other time when the boat operator requests assistance.

ACCIDENT PROCEDURES:

In the event of a diving accident, the boat operator is the primary person responsible for the vessel and crew, and shall:

1. Maintain a position at the helm seat and navigate the boat;

2. Be the primary person to contact the Anderson.

3. If the accident involves the boat operator, the dive master or alternate dive master will designate a person to operate the boat.

EPA FLOAT PLAN

Complete this plan, before leaving and leave it with the responsible person who can be depended upon to notify the Coast Guard, or other rescue organization, should you not return as scheduled.

TODAY'S DATE _____(if overnight, date returning)_____

1. NAME OF PERSON REPORTING_____
TELEPHONE NUMBER_____

2. DESCRIPTION OF BOAT
TYPE_____
COLOR_____
TRIM_____
REGISTRATION NO._____
LENGTH_____
NAME_____
MAKE_____
OTHER INFO._____

3. NUMBER OF PERSONS ABOARD_____
NAME_____
NAME_____
AGE_____
AGE_____
ADDRESS_____
ADDRESS_____
_____ -
_____
PHONE #_____ PHONE #_____
Please list additional passengers and information of the back of this form.

4. TRIP EXPECTATIONS: LEAVE
AT_____(TIME)
FROM_____
_____
GOING
TO_____
EXPECT TO RETURN
BY_____(TIME)
AND IN NO EVENT LATER
THAN_____(TIME)

5. IF NOT RETURNED BY_____(TIME), CALL THE COAST GUARD, OR
_____(LOCAL AUTHORITY)

6. ENGINE TYPE_____
H.P._____
NO. OF ENGINES_____ FUEL
CAPACITY_____

7. SURVIVAL EQUIPMENT: (CHECK AS APPROPRIATE)
_____ PFDs _____ FLARES _____ MIRROR _____ SMOKE SIGNALS
_____ CLOTHING _____ FLASHLIGHT _____ FOOD _____ PADDLES
_____ WATER _____ OTHERS _____ ANCHOR _____ RAFT OR DINGHY
_____ EPIRB

8. RADIO: _____YES _____NO
TYPE_____
FREQS._____

9. ANY OTHER PERTINENT
INFO._____
_____
_____

10. AUTOMOBILE LICENSE _____ TYPE _____

TRAILER LICENSE_____ COLOR/MAKE OF AUTO_____

WHERE PARKED_____